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DOMINION OF CANADA - DEPARTMENT OF AGRICULTURE

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by

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INTRODUCTION

The taxonomy of North American fleas has received considerable attention during the last half-century. However, such monographic works as have appeared to the present time have dealt almost exclusively with the fleas of the United States. Inasmuch as indigenous Canadian mammals and birds support a rich flea fauna, containing many species not known elsewhere in North America, it appears justifiable at this time to present a summary of present knowledge of the species occurring in the Dominion of Canada.

Interest in Canadian Siphonaptera began in the provinces of British Columbia and Alberta, where amateur naturalists and professional trappers such as A. D. Gregson, Allan Brooks, G. F. Dippie and others collected large numbers of these insects for the Hon. N. Charles Rothschild of Tring, England. Many new species were described by Rothschild and Dr. Karl Jordan from this material. In addition, Dr. Carl F. Baker, in his works on North American fleas (1895-1905) described three species from the Queen Charlotte Islands, B.C., and many others from the United States, of which a number have since been shown to occur also in Canada. In more recent years, collections of fleas made by Professor G. J. Spencer of the University of British Columbia, and Eric Hearle of the Dominion Entomological Laboratory at Kamloops, B.C. have been submitted to Dr. Julius Wagner of Belgrade, Yugoslavia, who recognized and described several additional species, and who also added considerably to the distributional knowledge of the siphonapterous fauna of British Columbia.

Since 1938, interest in the fleas of British Columbia and Alberta has again been aroused in connection with the sylvatic (=bubonic) plague surveys conducted by the Health Departments of those provinces, under the direction of the Dominion Department of National Health and Welfare and the Dominion Department of Agriculture Laboratories at Kamloops. In the spring of 1942, the Public Health Department of Saskatchewan was prompted to organize a plague survey, as *Pasteurella pestis* had been isolated from ground squirrels *(Citellus r. richardsonii)* and their fleas in Divide County, North Dakota, just south of the Canadian border the previous year (Pub. Hlth. Repts. 57(24):903), as well as from certain areas in Alberta in 1939 (Gibbons and Humphreys, 1941:26). Furthermore, the Indian rat flea, *Xenopsylla cheopis* (Rothschild) had been discovered in significant numbers in certain areas in Vancouver and other Pacific coast cities (Holland 1940, 1941, 1944). Brown (1944) published a list of the fleas of Alberta, and other papers dealing with the plague situation.

Members of the staff of the Livestock Insects Laboratory at Kamloops have been able to do considerable collecting of fleas from a wide variety of hosts in the three western provinces. Also, the writer has had the opportunity of examining much of the material sent to the Laboratory of Hygiene at Kamloops by the plague survey crews. In addition, many fleas from scattered localities have been submitted by various collectors. As a result of all this accumulation of material, many interesting and important records have been made, as well as notes on host relationships and geographical distribution not hitherto published.

The eastern provinces of Canada and the coast of Labrador have been singularly neglected with reference to systematic collecting, and published records of fleas are few. This holds true also for the far north. Recently, the writer had the opportunity of studying the Siphonaptera in the Canadian National Collection at Ottawa. The bulk of this material is from Ontario

with small series from Manitoba, Quebec, the Maritimes and Northwest Territories, and while the collection is not large, it serves to give a fairly representative picture of the species occurring in those parts of the country.

The present paper, then, brings together all available published and unpublished data, up to December 31, 1946, and is intended as a guide to the known flea fauna of Canada.

Descriptions and discussions of families, subfamilies and genera are given. Categories below genera are not formally described in detail except in a few instances where new species or subspecies are established, or where the description of the male or female of a species known previously only from the opposite sex, is provided. Otherwise, the various species and subspecies are treated only by means of keys, illustrations and sometimes brief notes on structures of particular diagnostic significance. All available host and locality records of the fleas known to occur in this country are listed. Under the discussion of each species, selected literature references are given. These do not comprise a complete bibliography*, but are merely references to the original description, important supplementary descriptions, if any, and papers recording the species in Canada.

Previous records of localities and hosts are summarized, and the nomenclature of the hosts brought up to date insofar as possible. Where synonymy or revisions have made changes necessary, the host name as originally recorded is given in quotation marks, with the corrected name following in parentheses. In addition, where the names of localities have been misspelled or not clearly expressed in previous publications, corrections or explanatory notes are appended. Records include, wherever possible, dates of collection and numbers of specimens obtained. It is felt that this information should be made available as certain fleas show trends towards abundance at particular seasons of the year. These data are not included in the case of domestic infestations of certain Old-World species.

All new records are from material studied and preserved at the Livestock Insects Laboratory, Kamloops, B.C., the Canadian National Collection, Ottawa, Ont., or the Department of Zoology, University of British Columbia, Vancouver, B.C.

To date there are records of 127 species and subspecies of fleas belonging to five families occurring in the Dominion of Canada. Of these, six species are believed to have been introduced from Europe or Asia, being common parasites of man and domestic animals, and now are almost cosmopolitan in distribution. The remaining 121 are regarded as indigenous. A very few of these are circumpolar in distribution, being apparently identical with corresponding fleas in northern Europe and Asia.

Four new species, one new subspecies, and the males or females of three other species, previously known only from the opposite sex, are described. In addition, one new subfamily is proposed.

Of recent years it has been the practice at this laboratory to prepare scientific study skins representative of all species of mammals and birds taken during the course of field collecting of ectoparasites (see Appendix A.). Thus, if there is any doubt whatsoever as to the exact species of a particular host, the skin may be submitted to a reputable mammalogist or ornithologist for identification. Correct host diagnosis is of paramount importance in the recording of flea species if an accurate understanding of the various relationships is to be obtained. In the present work, the common name, or perhaps the genus of the host may be all that is given in cases where there are no means of checking the identification definitely. Records include the subspecific or racial name of

* The reader is referred to Jellison and Good "Index to the Literature of Siphonaptera of North America", Nat. Inst. Hlth. Bul. No. 178, 1942, for a complete bibliography up to July, 1939.

the host only under the following alternative circumstances (1) where scientific skins and skulls were prepared at the time the fleas were collected and have been identified, and are available for further reference or study (2) where the collector has been a competent mammalogist or ornithologist whose host-diagnoses may be accepted with confidence, (3) where there is available a published list of the mammals of a particular locality from which flea specimens have been collected, or (4) when the host was collected in a well-known and established range of a particular subspecies, and where there could be no possibility of confusion with some other animal.

Later note

Since completion of the manuscript of the present paper, an important contribution to the literature of Siphonaptera has come to hand. This is the monumental publication of C. Andresen Hubbard (Fleas of Western North America, Iowa State College Press, 1947). In this work, Dr. Hubbard reviews all available published literature concerning the species of fleas recorded from North America west of the 100th Meridian, and from Mexico north to, and including Alaska. This mass of material is supplemented by an astonishing number of records established through his own energetic and enthusiastic field-collecting, which covered more particularly the states of Washington, Oregon, Nevada, Idaho, Arizona, northern California and southern Utah. In the years that he has devoted to the study of fleas, especially in the rich area of the Pacific Northwest, Dr. Hubbard has probably collected personally more of these insects than any other single investigator, past or present. His book contains much information on the history of flea study in western North America, and sections on field and laboratory techniques, domestic and public health significance of fleas in North America (practically all published work being summarized) and much valuable information on the habits of the host animals.

Discussions and opinions relating to fundamental taxonomic problems, however, are not stressed, so that no important original contribution is made towards an understanding of phylogenetic relationships, or to the evolution of a satisfactory basic classification for this order of insects. In view of this, and the fact that virtually no new Canadian records are included, or much supplementary data to that already available concerning the majority of the species known from this country, the writer has not deemed it necessary to alter the present text, but is leaving it in its original form. Also, Dr. Hubbard's and the writer's views on certain points of synonymy are at variance, as comparison of the texts of the two papers will reveal.

ACKNOWLEDGMENTS

Thanks are expressed to H. G. Crawford, Dominion Entomologist, with whose approval the present study was carried out, and to Dr. J. McDunnough, former Chief of Systematic Entomology, Ottawa, who arranged that the fleas contained in the Canadian National Collection should be sent to Kamloops for study. This included the types of most of the Canadian species described by the late Dr. Julius Wagner of Belgrade, Yugoslavia.

Through the courtsey of Dr. E. A. Chapin, Curator of Insects, United States National Museum, and Dr. C. F. W. Muesebeck, the author was able to examine, at Washington, the types of most of the species described by Baker, Carroll Fox, Ewing, Irving Fox and Hubbard, as well as some paratypes of species described by Jordan. By these means it has been possible to study type material of 53 of the 127 species and subspecies of fleas so far recorded from Canada, and also to settle several controversial points of synonymy.

Grateful acknowledgment is made of the friendly encouragement of Professor G. J. Spencer of the Department of Zoology, University of British Columbia, who assisted the author through early difficulties by making available his extensive collections of Siphonaptera, along with literature and valuable files of correspondence with Dr. Wagner.

Dr. Ian McTaggart Cowan, also of the University of British Columbia, has given much of his time and advice on matters pertaining to the distribution in Canada of certain genera and species of mammals. In addition, Dr. Cowan has identified the study skins of host mammals prepared by the writer, and has, from time to time, provided valuable collections of fleas obtained during his own researches and field studies on western Canadian mammals.

The energetic field collecting of various former members of the staff of the Livestock Insects Laboratory at Kamloops is acknowledged, mentioning especially the late Eric Hearle, the late Donald Cameron, T. K. Moilliet, now of Vavenby, B.C., and G. Allen Mail, former officer in charge of this laboratory, under whose direction the writer commenced the study of fleas.

Special thanks are extended to J. D. Gregson, for his patient interest and ready advice as well as for uncounted hours of overtime spent in setting out traps and examining nests in efforts to allay the writer's seemingly insatiable appetite for more and more fleas! In addition Mr. Gregson checked much of the present manuscript during its formative stages, and personally tested the keys to genera and species.

Thanks are due also to various specialists in the Siphonaptera, especially to Dr. Karl Jordan, F.R.S., of the Zoological Museum at Tring, Dr. William L. Jellison of the Rocky Mountain Laboratory, Hamilton, Montana, and Major Robert Traub of the Division of Parasitology, Army Medical Center, Washington, D.C. These men, besides contributing important specimens of fleas, by loan or gift, have given freely of their time and advice over a period of years, and in addition have checked over the present manuscript, and offered many valued suggestions. Other specialists in the Siphonaptera who have contributed advice and/or specimens, or who have otherwise facilitated the preparation of this paper are: Dr. Alfonso Dampf of the Escuela Nacional De Ciencas Biologicas, Mexico City; Dr. Irving Fox, formerly of the University of Iowa; Dr. Henry S. Fuller of the Bowman Gray School of Medicine, Winston-Salem, North Carolina; Dr. Newell E. Good, formerly of the Plague Suppressive Measures Laboratory, San Francisco, California; Dr. C. Andresen Hubbard of Tigard, Oregon; E. W. Jameson Jr., of Cornell University, Ithaca, New York;

Glen M. Kohls of the Rocky Mountain Laboratory, Hamilton, Montana; F. M. Prince of the Plague Suppressive Measures Laboratory, San Francisco; Dr. M. A. Stewart of the Department of Entomology and Parasitology, University of California, Berkeley; P. Quentin Tomich, formerly of the University of California, Berkeley, and the late Dr. Julius Wagner of Belgrade, Yugoslavia.

Finally, the author desires to acknowledge the efforts of a long list of collectors who have submitted specimens to this laboratory. Some of these have collected fleas incidental to their own field studies on mammals or birds, or as professional trappers. Others had no fundamental personal interest in this or related biological study, but made special efforts to obtain these insects through sheer good-fellowship and the friendly desire to co-operate. The Royal Canadian Mounted Police of various detachments in the Northwest Territories deserve special mention. Through the intercession of S. T. Wood, Commissioner, and Inspector A. G. Birch, Commanding Fort Smith Subdivision, it has been possible to obtain valuable series of these insects from the Canadian Northlands.

William Fuller, of the Bureau of Northwest Territories and Yukon Affairs, Fort Smith, N.W.T., has been a most reliable field collector of fleas, and, during the past five years has sent in hundreds of specimens from Saskatchewan, northern Alberta and the Northwest Territories.

In the records of fleas given in the body of the text, the collector's identities are indicated by initials. A complete glossary of these initials is given in Appendix C. The author wishes to express grateful thanks to all of these. It is hoped that they and others will continue to collect fleas and submit them to the Division of Entomology, Ottawa, or the Livestock Insects Laboratory at Kamloops, as the study of the fleas of Canada is by no means a completed project.

SYNOPSIS OF THE FLEAS OF CANADA

Family 1, PULICIDAE Stephens

Subfamily A. *Spilopsyllinae* Oudemans

Cediopsylla inaequalis inaequalis (Baker)
C. simplex (Baker)
Hoplopsyllus affinis (Baker)
H. glacialis glacialis (Taschenberg)
H. glacialis lynx (Baker)

Subfamily B. *Pulicinae* Tiraboschi

Ctenocephalides canis (Curtis)
C. felis felis (Bouché)
Pulex irritans Linnaeus
Xenopsylla cheopis (Rothschild)

Family 2, VERMIPSYLLIDAE Wagner

Arctopsylla setosa (Rothschild)
A. ursi (Rothschild)

Family 3, HYSTRICHOPSYLLIDAE Tiraboschi

Subfamily A. *Hystrichopsyllinae* Tiraboschi

Saphiopsylla bishopi (Jordan)
Atyphloceras artius Jordan
A. multidentatus (C. Fox)
Hystrichopsylla gigas (Kirby)
H. dippiei Rothschild
H. tahavuana Jordan
H. occidentalis, n. sp.
H. spinata, n. sp.
H. schefferi Chapin
Stenoponia americana (Baker)

Subfamily B. *Neopsyllinae* Oudemans

Catallagia chamberlini Hubbard
C. charlottensis (Baker)
C. decipiens Rothschild
Delotelis telegoni (Rothschild)
Epitedia scapani (Wagner)
E. wenmanni (Rothschild)
Neopsylla inopina Rothschild
Tamiophila grandis (Rothschild)
Meringis shannoni (Jordan)

Subfamily C. *Rhadinopsyllinae* Wagner

Micropsylla sectilis sectilis (Jordan and Rothschild)
M. sectilis goodi Hubbard
Rectofrontia fraterna (Baker)
Trichopsylloides oregonensis Ewing

Subfamily D. *Ctenophthalminae* Rothschild

Ctenophthalmus pseudagyrtes Baker
Doratopsylla blarinae C. Fox
Corrodopsylla curvata curvata (Rothschild)
C. curvata obtusata (Wagner)

Subfamily E. *Anomiopsyllinae* Baker
- *Callistopsyllus terinus* (Rothschild)
- *C. campestris*, n. sp.
- *Megarthroglossus divisus divisus* (Baker)
- *M. divisus exsecatus* Wagner
- *M. procus* Jordan and Rothschild
- *M. pygmaeus* Wagner
- *M. sicamus* Jordan and Rothschild
- *M. similis* Wagner
- *M. spenceri* Wagner
- *Conorhinopsylla stanfordi* Stewart

Subfamily F. *Nearctopsyllinae*, new subfamily
- *Corypsylla ornata* C. Fox
- *Nearctopsylla brooksi* (Rothschild)
- *N. genalis hygini* (Rothschild)
- *N. genalis laurentina* Jordan and Rothschild
- *N. hyrtaci* (Rothschild)
- *N. jordani* Hubbard

Family 4, CERATOPHYLLIDAE Dampf

Subfamily A. *Amphipsyllinae* Dampf
- *Amphipsylla sibirica pollionis* (Rothschild)
- *Ctenophyllus terribilis* (Rothschild)
- *Odontopsyllus dentatus* (Baker)

Subfamily B. *Dolichopsyllinae* Baker
- *Dolichopsyllus stylosus* (Baker)

Subfamily C. *Ceratophyllinae* Dampf
- *Oropsylla alaskensis* (Baker)
- *O. arctomys* (Baker)
- *O. idahoensis* (Baker)
- *O. rupestris* (Jordan)
- *Thrassis acamantis* (Rothschild)
- *T. bacchi* (Rothschild)
- *T. petiolatus* (Baker)
- *T. spenceri* Wagner
- *Amphalius necopinus* (Jordan)
- *Dactylopsylla comis* Jordan
- *Foxella ignota albertensis* (Jordan and Rothschild)
- *F. ignota recula* (Jordan and Rothschild)
- *Opisocrostis bruneri* (Baker)
- *O. labis* (Jordan and Rothschild)
- *O. saundersi* (Jordan)
- *O. tuberculatus tuberculatus* (Baker)
- *Opisodasys keeni* (Baker)
- *O. pseudarctomys* (Baker)
- *O. vesperalis* (Jordan)
- *Orchopeas caedens caedens* (Jordan)
- *O. caedens durus* (Jordan)
- *O. leucopus* (Baker)
- *O. nepos* (Rothschild)
- *O. sexdentatus agilis* (Rothschild)
- *O. howardii* (Baker)
- *Tarsopsylla coloradensis* (Baker)
- *Ceratophyllus adustus* Jordan
- *C. celsus celsus* Jordan
- *C. diffinis* Jordan

C. gallinae (Schrank)
C. garei Rothschild
C. idius Jordan and Rothschild
C. niger C. Fox
C. petrochelidoni Wagner
C. riparius Jordan and Rothschild
C. tundrensis Holland
Dasypsyllus gallinulae perpinnatus (Baker)
Malaraeus bitterrootensis (Dunn)
M. euphorbi (Rothschild)
M. penicilliger dissimilis Jordan
M. telchinum (Rothschild)
Megabothris abantis (Rothschild)
M. acerbus (Jordan)
M. asio asio (Baker)
M. asio megacolpus (Jordan)
M. atrox (Jordan)
M. groenlandicus (Wahlgren)
M. immitis (Jordan)
M. lucifer (Rothschild)
M. obscurus, n. sp.
M. quirini (Rothschild)
Monopsyllus ciliatus protinus (Jordan)
M. eumolpi eumolpi (Rothschild)
M. thambus (Jordan)
M. vison (Baker)
M. wagneri wagneri (Baker)
M. wagneri ophidius (Jordan)
M. wagneri systaltus (Jordan)
Nosopsyllus fasciatus (Bosc d'Antic)

Subfamily D. *Leptopsyllinae* Rothschild
Leptopsylla segnis (Schönherr)
Peromyscopsylla catatina (Jordan)
P. hamifer hamifer (Rothschild)
P. hesperomys pacifica, n. ssp.
P. ravalliensis (Dunn)
P. selenis (Rothschild)

Family 5, Ischnopsyllidae Wahlgren
Eptescopsylla vancouverensis (Wagner)
Myodopsylla gentilis Jordan and Rothschild
M. insignis (Rothschild)
Myodopsylloides palposus (Rothschild)

DISTRIBUTION BY PROVINCES

The following lists summarize the distribution, by provinces, of fleas in Canada. The large number of records for British Columbia and Alberta as compared with those of the more easterly provinces is due in part to the fact that more thorough collecting has been done in the west. Also there is little doubt but that the western part of North America supports a much more diverse flea fauna. British Columbia in particular is partitioned longitudinally by complex series of mountain ranges which, coupled with other factors, have divided this province into more separate and distinct biotic areas than are to be traced in other parts of the Dominion. The diversity of the mammal faunas is reflected in the variety of their fleas.

In these lists, the fleas are recorded alphabetically. Details of records will be found under the discussion of each species.

British Columbia (89 species recorded)

Amphalius necopinus
Arctopsylla setosa
Arctopsylla ursi
Atyphloceras artius
Atyphloceras multidentatus
Callistopsyllus terinus
Catallagia chamberlini
Catallagia charlottensis
Catallagia decipiens
Ceratophyllus adustus
Ceratophyllus celsus celsus
Ceratophyllus diffinis
Ceratophyllus garei
Ceratophyllus idius
Ceratophyllus niger
Ceratophyllus petrochelidoni
Ceratophyllus riparius
Corrodopsylla curvata curvata
Corrodopsylla curvata obtusata
Corypsylla ornata
Ctenocephalides canis
Ctenocephalides felis felis
Ctenophyllus terribilis
Dactylopsylla comis
Dasypsyllus gallinulae perpinnatus
Delotelis telegoni
Dolichopsyllus stylosus
Epitedia scapani
Epitedia wenmanni
Eptescopsylla vancouverensis
Foxella ignota recula
Hoplopsyllus glacialis lynx
Hystrichopsylla dippiei
Histrichopsylla occidentalis
Hystrichopsylla spinata
Hystrichopsylla schefferi
Leptopsylla segnis
Malaraeus euphorbi
Malaraeus penicilliger dissimilis
Malaraeus telchinum
Megabothris abantis
Megabothris asio megacolpus
Megabothris lucifer
Megabothris quirini
Megarthroglossus divisus divisus
Megarthroglossus divisus exsecatus
Megarthroglossus procus
Megarthroglossus pygmaeus
Megarthroglossus sicamus
Megarthroglossus similis
Megarthroglossus spenceri
Meringis shannoni
Micropsylla sectilis goodi
Micropsylla sectilis sectilis
Monopsyllus ciliatus protinus
Monopsyllus eumolpi eumolpi
Monopsyllus vison
Monopsyllus wagneri ophidius
Monopsyllus wagneri wagneri
Myodopsylla gentilis
Myodopsylla insignis
Myodopsylloides palposus
Nearctopsylla brooksi
Nearctopsylla hyrtaci
Nearctopsylla jordani
Neopsylla inopina
Nosopsyllus fasciatus
Opisocrostis tuberculatus tuberculatus
Opisodasys keeni
Opisodasys pseudarctomys
Opisodasys vesperalis
Orchopeas caedens caedens
Orchopeas caedens durus

British Columbia (continued)

Orchopeas leucopus
Orchopeas nepos
Orchopeas sexdentatus agilis
Oropsylla arctomys
Oropsylla idahoensis
Peromyscopsylla hesperomys pacifica
Peromyscopsylla ravalliensis
Peromyscopsylla selenis
Pulex irritans
Rectofrontia fraterna
Tarsopsylla coloradensis
Thrassis acamantis
Thrassis petiolatus
Thrassis spenceri
Trichopsylloides oregonensis
Xenopsylla cheopis

Alberta (57 species)

Amphalius necopinus
Amphipsylla sibirica pollionis
Arctopsylla ursi
Callistopsyllus campestris
Catallagia decipiens
Cediopsylla inaequalis inaequalis
Ceratophyllus garei
Ceratophyllus niger
Corrodopsylla curvata curvata
Ctenocephalides canis
Ctenocephalides felis felis
Ctenophthalmus pseudagyrtes
Ctenophyllus terribilis
Epitedia wenmanni
Foxella ignota albertensis
Hoplopsyllus glacialis lynx
Hystrichopsylla dippiei
Malaraeus bitterrootensis
Malaraeus euphorbi
Malaraeus penicilliger dissimilis
Megabothris abantis
Megabothris asio megacolpus
Megabothris atrox
Megabothris lucifer
Megabothris obscurus
Megabothris quirini
Megarthroglossus divisus divisus
Monopsyllus eumolpi eumolpi
Monopsyllus thambus
Monopsyllus vison
Monopsyllus wagneri systaltus
Monopsyllus wagneri wagneri
Myodopsylla insignis
Nearctopsylla brooksi
Nearctopsylla genalis hygini
Neopsylla inopina
Odontopsyllus dentatus
Opisocrostis bruneri
Opisocrostis labis
Opisocrostis tuberculatus tuberculatus
Opisodasys keeni
Opisodasys pseudarctomys
Orchopeas caedens caedens
Orchopeas caedens durus
Orchopeas leucopus
Orchopeas sexdentatus agilis
Oropsylla arctomys
Oropsylla idahoensis
Oropsylla rupestris
Peromyscopsylla hamifer hamifer
Peromyscopsylla selenis
Pulex irritans
Rectofrontia fraterna
Tarsopsylla coloradensis
Thrassis bacchi
Thrassis petiolatus
Thrassis spenceri

Saskatchewan (36 species)

Callistopsyllus campestris
Catallagia decipiens
Cediopsylla inaequalis inaequalis
Ceratophyllus gallinae
Ceratophyllus riparius
Corrodopsylla curvata curvata
Ctenophthalmus pseudagyrtes
Epitedia wenmanni
Foxella ignota albertensis
Hoplopsyllus affinis
Hystrichopsylla dippiei
Malaraeus euphorbi
Megabothris asio megacolpus
Megabothris lucifer
Megabothris quirini
Monopsyllus eumolpi eumolpi
Monopsyllus thambus
Monopsyllus vison
Monopsyllus wagneri systaltus
Myodopsylla insignis
Nearctopsylla genalis hygini
Neopsylla inopina
Nosopsyllus fasciatus
Odontopsyllus dentatus
Opisocrostis bruneri
Opisocrostis labis
Opisocrostis saundersi

Saskatchewan (continued)

Opisocrostis tuberculatus tuberculatus
Orchopeas caedens caedens
Orchopeas leucopus
Oropsylla arctomys
Oropsylla rupestris
Peromyscopsylla selenis
Pulex irritans
Rectofrontia fraterna
Thrassis bacchi

Manitoba (14 species)

Ceratophyllus gallinae
Ceratophyllus garei
Ctenophthalmus pseudagyrtes
Epitedia wenmanni
Nearctopsylla genalis hygini
Opisocrostis bruneri
Orchopeas caedens durus
Orchopeas leucopus
Oropsylla arctomys
Oropsylla rupestris
Peromyscopsylla selenis
Pulex irritans
Stenoponia americana
Thrassis bacchi

Ontario (29 species)

Cediopsylla simplex
Ceratophyllus diffinis
Ceratophyllus gallinae
Conorhinopsylla stanfordi
Corrodopsylla curvata curvata
Ctenocephalides canis
Ctenocephalides felis felis
Ctenophthalmus pseudagyrtes
Doratopsylla blarinae
Epitedia wenmanni
Hystrichopsylla tahavuana
Megabothris acerbus
Megabothris asio ssp.
Megabothris quirini
Monopsyllus eumolpi eumolpi
Monopsyllus vison
Myodopsylla insignis
Nearctopsylla genalis laurentina
Nosopsyllus fasciatus
Opisodasys pseudarctomys
Orchopeas caedens durus
Orchopeas leucopus
Orchopeas howardii
Oropsylla arctomys
Peromyscopsylla catatina
Peromyscopsylla hamifer hamifer
Saphiopsylla bishopi
Stenoponia americana
Tamiophila grandis

Quebec (14 species)

Ceratophyllus gallinae
Ceratophyllus garei
Ctenocephalides canis
Ctenocephalides felis felis
Epitedia wenmanni
Megabothris asio asio
Monopsyllus vison
Nosopsyllus fasciatus
Orchopeas leucopus
Oropsylla arctomys
Peromyscopsylla catatina
Peromyscopsylla hamifer hamifer
Pulex irritans
Stenoponia americana

New Brunswick (7 species)

Ceratophyllus gallinae
Epitedia wenmanni
Hoplopsyllus glacialis lynx
Nearctopsylla genalis laurentina
Orchopeas caedens durus
Oropsylla arctomys
Stenoponia americana

Nova Scotia (1 species)

Ceratophyllus riparius

Prince Edward Island (1 species)

Pulex irritans

Yukon Territory (4 species)

Hoplopsyllus glacialis lynx
Nearctopsylla brooksi
Orchopeas caedens caedens
Orchopeas leucopus

Northwest Territories (18 species)

Ceratophyllus tundrensis
Epitedia wenmanni
Hoplopsyllus glacialis glacialis
Hoplopsyllus glacialis lynx
Hystrichopsylla gigas
Malaraeus penicilliger dissimilis
Megabothris asio megacolpus
Megabothris atrox
Megabothris groenlandicus
Megabothris quirini
Mosopsyllus thambus
Monopsyllus vison
Orchopeas caedens caedens
Orchopeas caedens durus
Orchopeas leucopus
Oropsylla alaskensis
Peromyscopsylla selenis
Tarsopsylla coloradensis

NOTES ON LIFE HISTORY AND ECOLOGY

Fleas are highly specialized insects, adapted to an ectoparasitic existence on warm-blooded hosts. The great majority of species infests the smaller Mammalia, especially members of the orders Insectivora, Chiroptera and Rodentia*. A few genera of fleas are associated with certain large Carnivora, and some small groups (derived from mammal-fleas) are restricted to birds.

While the life-histories of only a very few of the indigenous North American species are known in detail, they are probably much the same in essentials, with the exception of the members of the family Tungidae (not known in Canada) and possibly the Vermipsyllidae where the females remain attached to the host for a period of time, swelling up somewhat like a tick. With the remaining four families, however, the structure and habits of the various genera and species are more or less as summarized below.

The adults are small, apterous, laterally compressed, and variously clothed with backwardly directed spines and setae (see also section on flea anatomy, p. 39). The legs, particularly the hind pair are well developed and heavily armed with bristles. Fleas thus are ideally modified for an existence in the fur or feathers of the chosen hosts, where, by reason of their activity and details of structure, they are able to move about rapidly and securely, and escape detection.

The adults of both sexes feed upon blood. The mechanism of this act is treated in detail by Snodgrass (1946:17-20).

Mating usually occurs on the host animal, the male assuming a ventral position, and grasping the anterior abdomen of the female with his erected antennae, before effecting sexual union by means of the complicated terminalia. This procedure, with reference to *Ceratophyllus gallinae* (Schrank) was described fully by Lundblad (1927, Zool. Anzeiger 70(1,2)). The writer has noted that groundhogs *(Marmota flaviventris avara)* shot in the early spring, when they have just come out from hibernation are usually heavily infested with *Thrassis acamantis* (Rothschild), many pairs of which are to be found in copulation.

A flea's full quota of eggs is not laid all at once, but in small batches, over a considerable period of time, punctuated by blood meals which are necessary for their development. Successive matings are not necessary for the fertilization of future eggs, as spermatozoa from the initial pairing are stored in the spermatheca or receptaculum seminis of the female, and used as required.

The eggs are smooth, elliptical and ivory coloured. They may be laid in the host's nest or bedding, or in the host's fur or feathers, whence they drop into the nest or onto the ground. The larvae are slender, eruciform, apodous and quite active. They feed upon dried blood, the faeces of adult fleas and other organic materials. The pupal stage is exarate, and enclosed in a cocoon of silk and nest debris. After a period of time, varying with conditions and species, the imagines appear, and the cycle is thus completed.

Very little is known of the time involved in the life cycle of most of the native species, or how many broods may be produced in a year. Also, there is evidence that species vary in their peaks of seasonal abundance, so that some

* Including the "Lagomorpha". The writer follows Anderson (1946) in listing the rabbits, hares and pikas under the suborder Duplicidentata of the Rodentia. This arrangement is questioned by certain leading mammalogists.

species may be referred to as "winter fleas" etc., but there are few data available in this connection. Furthermore, the number of adult fleas that may be removed from an animal is not necessarily indicative of the number belonging to it, as by far the greater proportion of them is frequently to be found in the nest. Some species rarely leave the nests at all.

While in many instances the sexes appear to be about equally divided, there is not infrequently a preponderance of females. It has been suggested that the explanation may be that the males are shorter lived, and die soon after mating. Thus perhaps an abundance of males may indicate the true breeding season. It may be also that males are more prone to remain in the nests.

Developing and adult fleas are sensitive to extremes of temperature and humidity. This is almost undoubtedly the principal reason why these parasites tend to occur in relatively large numbers on the species of mammals and birds that characteristically live in burrows, or whose nests or lairs are otherwise well protected from storm and weather. Such nests further are eminently suited to the production of fleas because of the fact that the larval food materials consist of substances which are to be found in greatest profusion in the animal's bedding. Thus it is that animals that establish no permanent or well protected place of abode, or birds living in open or exposed nests do not tend to produce fleas in quantity. This is the case with sheep, goats, moose and most of the larger game animals, whereas coyotes and foxes, which live in dens, and bears, which hibernate in protected spots, may be infested to a greater degree. Again, the hares, such as *Lepus townsendii* and *L. americanus*, which live and raise their young in the open in "forms", carry only a fraction of the flea population to be found on the rabbits, like *Sylvilagus* spp. which inhabit burrows.

Insectivores and rodents are almost always heavily infested with fleas, and this undoubtedly is a result of the nesting habits of these mammals. Bats, while not living in nests, tend to congregate in caves or other confined quarters, thus providing suitable conditions for the breeding of fleas.

With birds, the species living in burrows, or which have closely confined and well protected nests, preserving a fairly high humidity, are not infrequently well populated with these insects. Thus, while fleas are occasionally taken on passerines, such as sparrows, thrushes *et al.* (especially in humid climates), much larger numbers are usually found on, or in the nests of, swallows and burrowing owls.

Aquatic mammals such as muskrats, beavers and otters have no characteristic fleas. On the other hand, certain aquatic birds, such as cormorants, eider and other ducks, geese, grebes, etc. are sometimes infested, although there are usually far more fleas in the nests than on the birds themselves. Some fleas, such as *Ceratophyllus garei* Rothschild seem to prefer the nests of ground-nesting birds, whether the host be a duck, grouse or sparrow! Predatory birds, such as hawks, owls and eagles are sometimes infested with the fleas of their rodent victims.

Reduction in size and pigmentation, or even absence of eyes is frequently to be found in the fleas of fossorial and nocturnal animals, while diurnal hosts usually have fleas possessing well developed eyes. In some cases these "eyeless" fleas belong to taxonomic groups regarded as primitive and normally with reduced eyes. Here would be included the members of the family Hystrichopsyllidae (on insectivores and rodents) and possibly the Ischnopsyllidae (on bats). Others which have reduced or rudimentary eyes, as certain genera of the Ceratophyllidae might be considered degenerate in this respect, as their congeners have well developed eyes. Here would be included *Amphipsylla* and *Malaraeus* (on mice), *Foxella* and *Dactylopsylla* (on pocket gophers, *Thomomys*), *Dolichopsyllus* (on mountain beavers, *Aplodontia*) etc.

Arctopsylla, *Monopsyllus*, *Oropsylla*, *Thrassis* and other genera infesting diurnal and sun-loving animals like bears, squirrels, chipmunks, ground squirrels, marmots, etc., and *Dasypsyllus* and *Ceratophyllus* on diurnal birds have relatively large eyes.

This correlation between eye development and habits of the host is by no means infallible. There are many notable exceptions such as *Opisodasys vesperalis* and *O. pseudarctomys*, both normal parasites of the strictly nocturnal flying squirrel *(Glaucomys)* and *Monopsyllus wagneri* and *Megabothris* spp., fleas of mice which are chiefly nocturnal. These fleas have well developed eyes, and may represent comparatively recent associations. Conversely, *Neopsylla inopina* and *Rectofrontia fraterna*, which are blind, are common and regular parasites of the sun-loving Richardson ground squirrel *(Citellus r. richardsonii)*. These two species are probably chiefly nest fleas.

HOST SPECIFICITY

Host preference varies tremendously in different genera and species of fleas. With some species there is a very obviously close association with a particular genus or species of host, whereas with others, a number of genera (or sometimes families) of host animals appears to be equally satisfactory. However, while *Thrassis acamantis* on the yellow-bellied marmot *(Marmota flaviventris)*, *Foxella ignota* on pocket gophers *(Thomomys)* and *Meringis shannoni* on pocket mice *(Perognathus)* represent extremes of specificity, nearly all species, genera or families of fleas show trends of relationship to particular hosts or groups of hosts, and to varying degrees. The origins of such associations are lost in antiquity, so that fundamental flea-host relationships may be pieced together only by inference and critical consideration of data provided by existing species.

While a few specimens of fleas have been preserved in amber, the fossil record is incomplete, and little is known of their ancient history. All evidences point to fleas having originated as ectoparasites of the early mammals, the transference of a few genera and species to birds being a comparatively recent development. The extreme modification of these insects, due to a specialized mode of life has made their affinities with other orders difficult to discern and interpret. Many and varied are the theories that have been postulated, concerning the probable origin of fleas*. Without doubt they are an ancient group, and were sufficiently well established on the early mammals to become diversified and associated with particular orders of hosts at a very remote date. This is well shown in the fleas of bats, which are almost as compact and well defined a group (family Ischnopsyllidae) as are the bat hosts themselves.

While the subject of flea-classification and evolutionary specialization is still a controversial matter (see also p. 47) it is now generally conceded that the Insectivora (primitive mammals) are typically infested with fleas which may be regarded as primitive. Further, as we go higher up the scale of mammals, the fleas tend to become more specialized†. In other words there is evidence that the general trend has been for fleas to evolve *with* the hosts — hosts of primitive orders today being infested by relatively unspecialized fleas (weak mouthparts, reduced eyes, many combs etc., and living chiefly in nests) while higher mammals in general have more highly developed and more parasitic fleas (well developed mouthparts, large, pigmented eyes, reduced combs and setae, and a tendency to become more or less permanently attached to host etc.). The fundamental association between fleas and their hosts, while complicated and at times obscured by actual or seeming contradictions, offers many hints and clues to the phylogeny of these insects. Jellison and Jordan have alluded to this fact in a number of papers, and the matter deserves the serious attention of any student of the Siphonaptera.

The following notes on flea-host relationships pertain only to Canada, a most arbitrary and political limitation of a phase of study that would gain more significance if expanded to a consideration of the whole of North America. Such, however, is beyond the scope of this paper.

The 121 indigenous species and subspecies of fleas so far recorded from Canada belong to 46 genera, representing five families. Of these, only two genera, comprising ten species, may be definitely associated with the birds, the

* Some of these are reviewed by Ewing and Fox (1943:10-13).

† This matter is discussed at some length by Jellison in an unpublished manuscript (1941).

remaining 44 (111 species and subspecies) being true mammal fleas. There are records, in Canada, of fleas from 51 genera of native mammal hosts. As two of these records, from *Ondatra* and *Erethizon* almost certainly indicate chance associations, there being no satisfactory evidence of fleas normally occurring on these mammals, and as a few others, from *Spilogale*, *Mephitis*, *Taxidea* and some other canivores are also doubtful, it will be seen that there is quite a striking parallel between the number of genera of mammals, and the genera of fleas infesting them. This becomes more apparent when the orders of mammals are considered separately. It is not intended to imply that each mammel genus has one special genus of flea, although such is frequently the case. Many mammals have several specific fleas, belonging to different genera. Other mammals do not have their own flea, but share one that belongs to another, usually a close relative. The point to be noted is that the orders of mammals that are parasitized by Siphonaptera (principally the Insectivora, Chiroptera and Rodentia) have, in total almost as great a variety of fleas as there are genera of mammals, substantiating the likelihood that the diversification of these flea-forms has, to a great extent, been a parallel development accompanying the evolution of the mammals.

The Insectivora (6 genera) are infested regularly by four genera of fleas that rarely occur on other hosts, and by four others that are shared with certain small Rodentia. All these fleas belong to the family Hystrichopsyllidae.

The Chiroptera, or bats (3 genera) are infested by three genera of fleas, all of the family Ischnopsyllidae, which is peculiar to these mammals.

The Carnivora (12 genera) have but one genus of flea, *Arctopsylla*, that appears to be definitely associated with some of them. This belongs to the Vermipsyllidae, a peculiarly specialized family, some members of which seem to be true parasites of Artiodactyla in other parts of the world. While many other fleas have been recorded from Carnivora, all (with the possible exception of one or perhaps two species of *Nearctopsylla* (Hystrichopsyllidae), on Mustelidae) may be regarded as accidental occurrences, to be explained by the predatory habits of these animals, whereby they become temporary hosts to the fleas of their victims.

The typical rodents, suborder Simplicidentata of the Rodentia (23 genera) possess 27 genera of fleas, plus four shared with the Insectivora. Of these, 17 belong to the Hystrichopsyllidae, and the remaining 14 to the Ceratophyllidae.

The suborder Duplicidentata, or pikas and rabbits (3 genera) have five genera of fleas, three belonging to the Ceratophyllidae and two to the Pulicidae.

The Artiodactyla, in northern North America are not ordinarily considered to have any true fleas, although there are several instances of *Pulex irritans* having been collected from deer, *Odocoileus*. In view of the association of the related genus *Juxtapulex* with *Pecari* and the fact that *P. irritans* readily infests domestic swine, it may be that these records are not the result of accident as has been supposed, but are further evidence of a true relationship between the even-toed hoofed mammals and some Pulicidae.

The two genera of fleas known to infest birds in Canada (*Ceratophyllus* and *Dasypsyllus)* plus one other (*Mioctenopsylla*, not yet reported, but doubtless occurring in the Canadian Arctic) have their affinities with the typical rodent fleas (subfamily Ceratophyllinae) and may have found their origin in the transference of certain fleas from arboreal rodents to avian nests in comparatively recent geologic times. Predation of small mammals by certain raptorial birds probably also played a part. The two genera of bird-fleas known from Canada have been collected from 36 genera of birds (excluding poultry) belonging to

nine orders. While a few of the species are fairly definitely associated with particular birds (as certain swallow-fleas) it will be seen that most of these fleas infest birds rather indiscriminately, and have developed none of the striking relationships evidenced with the mammal-fleas.

The following table summarizes the data on the relation of families of fleas to orders of hosts insofar as Canada is concerned.

An amplification of some of the above data is contained in the next table, which shows the approximate relationship between families, subfamilies and genera of indigenous Canadian fleas to genera, families and orders of hosts. Further information pertaining to this phase of study will be found in the section on Geographical Distribution (p. 29) and in the Host-Flea Index (p. 183).

Table I

HOST				FLEA		
Order	No. of genera in Canada*	No. of genera from which we have records	Species and subspecies	Family	No. of genera	Species and subspecies
INSECTIVORA	9	6	12+	Hystrichopsyllidae	8	12
CHIROPTERA	9	3	7+	Ischnopsyllidae	3	4
CARNIVORA (Fissipedia)	18	12	28+	Vermipsyllidae Hystrichopsyllidae	1 1 ?	2 1 ?
RODENTIA (Simplicidentata)	31	25	86+	Hystrichopsyllidae Ceratophyllidae	17 14	32 52
RODENTIA (Duplicidentata)	3	3	14+	Ceratophyllidae Pulicidae	3 2	3 5
ARTIODACTYLA	9	1	1	Pulicidae	1 ?	1 ?
BIRDS (9 orders)	—	36	40+	Ceratophyllidae	2	10

* According to Anderson **1946**, Catalogue of Canadian Recent Mammals.

Table II
Trends of host relationship

FLEA		HOST		
Family and subfamily	Genus	Genus	Family	Order
PULICIDAE				
Spilopsyllinae	*Cediopsylla*	*Sylvilagus*	Leporidae	Rodentia (Duplicid.)
	Hoplopsyllus	*Lepus*	Leporidae	Rodentia (Duplicid.)
Pulicinae	*Pulex*	*Odocoileus* (?)	Cervidae	Artiodactyla
VERMIPSYLLIDAE	*Arctopsylla*	*Euarctos* & *Ursus*	Ursidae	Carnivora
		Canis	Canidae	Carnivora
		Gulo	Mustelidae	Carnivora
		Felis & *Lynx*	Felidae	Carnivora
HYSTRICHOPSYLLIDAE				
Hystrichopsyllinae	*Saphiopsylla*	several	several	small Rodentia
	Atyphloceras			and Insectivora
	Hystrichopsylla			
	Stenoponia			
Neopsyllinae	*Catallagia*	*Peromyscus*	Cricetidae	Rodentia (Simplicid.)
	Delotelis	*Microtus* etc.	Cricetidae	Rodentia
	Epitedia	*Peromyscus*	Cricetidae	Rodentia
	Neopsylla	*Citellus*	Sciuridae	Rodentia
	Tamiophila	*Tamias*	Sciuridae	Rodentia
	Meringis	*Perognathus*	Heteromyidae	Rodentia
Rhadinopsyllinae	*Micropsylla*	*Peromyscus*	Cricetidae	Rodentia
	Rectofrontia	*Citellus* etc.	Sciuridae	Rodentia
	Trichopsylloides	*Aplodontia*	Aplodontidae	Rodentia
Ctenophthalminae	*Ctenophthalmus*			Insectivora and
				small Rodentia
	Doratopsylla	*Blarina*	Soricidae	Insectivora
	Corrodopsylla	*Sorex*	Soricidae	Insectivora
Anomiopsyllinae	*Callistopsyllus*	*Peromyscus*	Cricetidae	Rodentia
	Megarthroglossus	*Neotoma* and	Cricetidae and	Rodentia
		Tamiasciurus	Sciuridae	Rodentia
	Conorhinopsylla	*Glaucomys* and		
		Tamiasciurus	Sciuridae	Rodentia
Nearctopsyllinae	*Corypsylla*	*Scapanus*	Talpidae	Insectivora
	Nearctopsylla	*Sorex*	Soricidae	Insectivora
CERATOPHYLLIDAE				
Amphipsyllinae	*Amphipsylla*	*Clethrionomys*	Cricetidae	Rodentia (Simplicid.)
	Ctenophyllus	*Ochotona*	Ochotonidae	Rodentia (Duplicid.)
	Odontopsyllus	*Sylvilagus*	Leporidae	Rodentia (Duplicid.)
Dolichopsyllinae	*Dolichopsyllus*	*Aplodontia*	Aplodontidae	Rodentia (Simplicid.)
Ceratophyllinae				
(Group A)	*Orchopeas*	several	Cricetidae and	Rodentia
			Sciuridae	Rodentia
	Opisodasys	several	Cricetidae and	Rodentia
			Sciuridae	Rodentia
	Tarsopsylla	*Glaucomys* and	Sciuridae	Rodentia
		Tamiasciurus		
(Group B)	*Amphalius*	*Ochotona*	Ochotonidae	Rodentia (Duplicid.)
	Dactylopsylla	*Thomomys*	Geomyidae	Rodentia (Simplicid.)
	Foxella	*Thomomys*	Geomyidae	Rodentia
	Thrassis	*Citellus* and	Sciuridae	Rodentia
		Marmota	Sciuridae	Rodentia
	Oropsylla	*Citellus* and	Sciuridae	Rodentia
		Marmota	Sciuridae	Rodentia
	Opisocrostis	*Citellus*	Sciuridae	Rodentia
(Group C)	*Ceratophyllus*	many	several	Class AVES
	Dasypsyllus	many		AVES, mostly
				Passeriformes
	Malaraeus	several	Cricetidae	Rodentia
	Megabothris	several	Cricetidae and	Rodentia
			Sciuridae	Rodentia
	Monopsyllus	several	Cricetidae and	Rodentia
			Sciuridae	Rodentia
Leptopsyllinae	*Peromyscopsylla*	*Peromyscus* and	Cricetidae	Rodentia
		Neotoma	Cricetidae	Rodentia
ISCHNOPSYLLIDAE	*Eptescopsylla*	*Lasionycteris*	Vespertilionidae	Chiroptera
	Myodopsylla	*Myotis*	Vespertilionidae	Chiroptera
	Myodopsylloides	*Eptesicus*	Vespertilionidae	Chiroptera

GEOGRAPHICAL DISTRIBUTION OF FLEAS IN CANADA

Extensive collecting of fleas over wide territories reveals the fact that the various species exhibit marked limitations in geographical distribution, inviting speculation and study as to the reasons for such restriction. From the evidence at hand it would seem that geographical range of flea species is controlled in two principal ways which might be briefly defined as (1) distribution of true or typical hosts and (2) climatic or other ecological factors independent of the range of the preferred host or hosts. Enlarging upon these:

1. Distribution of the "true host"

As some fleas show marked preferences for particular hosts, it is obvious then that the geographical range of such fleas will be directly controlled by the distribution of the hosts. For example, *Amphalius necopinus* and *Ctenophyllus terribilis* are specific parasites of the rock rabbit or pika (*Ochotona* sp.)and are never found outside the range of this mammal. So very particular are these two species of fleas that there are not any available records of their occurrence on any other mammals whatsoever. Other fleas however, while definitely associated with a particular host, are not infrequently taken on the predators of that host, or as strays on other mammals that may be in close association with the host. An example would be *Orchopeas 6-dentatus* ssp., a true parasite of the woodrat (*Neotoma cinerea* ssp.) but not infrequently taken on such predators as the spotted skunk *(Spilogale)* and weasels and mink *(Mustela)* or on such associated mammals as *Ochotona*, when pikas and woodrats inhabit the same rocky talus. (Compare, however, with the true pika fleas previously mentioned, which are *not* shared with the woodrat!) Again, *Foxella ignota* ssp. is a true parasite of pocket gophers *(Thomomys)*, but is sometimes taken on weasels *(Mustela)* or on ground squirrels *(Citellus)* where these mammals are in contact with *Thomomys*.

The physiological requirements of these monozoid fleas are extremely delicately balanced. This is well shown by the fact that within the range of the "true host" some of them (as with the examples quoted above) may be recorded upon other mammals, sometimes closely related, and frequently mammals of wider distribution than the true host—and yet the distribution of the flea continues to remain restricted! This appears to indicate that while these latter or secondary relationships do exist, occurring through predation or habitat association, the fleas are unable to reproduce on these unnatural hosts. Either the host's blood is distasteful or otherwise unsuitable for the adults, or nest conditions are in some way unsatisfactory for the flea-larvae. *Orchopeas howardii* offers an example. This flea is confined (normally) to eastern North America where its range coincides with that of the grey squirrel, *Sciurus carolinensis* ssp., which may be regarded as the true host. It is not infrequently taken on red squirrels, *Tamiasciurus hudsonicus* and flying squirrels, *Glaucomys* spp. and other mammals, such as mice, weasels, opossum, etc. (Fox 1940:60-62 lists records from 18 genera of hosts) so long as these mammals occur within the range of *Sciurus carolinensis*. The red squirrels and flying squirrels mentioned, logically the most suitable of all these alternative hosts, and of much wider geographical range than *S. carolinensis*, are apparently not satisfactory to the well-being and propagation of this very selective flea, as it is not found on these mammals in areas outside of the distribution of the true host. That the limitation in distribution is not governed by climatic or other factors rather than host-preference is evidenced by the fact that *O. howardii* is well established in various areas of the British Isles where *Sciurus carolinensis* has been introduced. The

red squirrel, *Tamiasciurus hudsonicus* ssp. on the other hand, is parasitized by the widespread *Orchopeas caedens* ssp. throughout its range. Where the range of this squirrel terminates in south west British Columbia, the range of *O. caedens* terminates also, being replaced by *Orchopeas nepos*, a distinct species, infesting the equally distinct *Tamiasciurus douglassi* (see map 30).

This is a phase of flea study that requires much further attention. Accurate recordings of the flea species reared from the nests of known species of mammals and birds would reveal much to augment our knowledge as to which were the true hosts and which transitory. From the data now available, the following table seems to present a valid statement on certain fleas geographically restricted in Canada by reason of the limit of range of specific or true hosts.

2. Geographical limitation by climatic factors

The distribution of certain other fleas does not seem to be entirely dependent upon the territory occupied by a specific or preferred host. With these, the distribution in a particular direction may be stopped by a physiographical barrier, usually, but not always, a mountain range, although the *hosts may continue past the barrier.* The mouse fleas, which are profuse in numbers and variety make a particularly interesting demonstration in this connection. Some genera and species are highly specific (as *Meringis shannoni* on *Perognathus parvus* ssp.) but many appear to infest rather indiscriminately all genera and species of mice within a particular district. For example, the writer collected *Megabothris abantis* at Kinbasket Lake, B.C., from *Peromyscus*, *Phenacomys*, *Zapus*, *Microtus*, *Clethrionomys* and even from *Neotoma*, *Ochotona* and *Mustela.* The last three of these were probably accidental strays, but many specimens were collected from the five genera of mice named, and it is likely that all, especially the microtines, are satisfactory hosts. Mice of these genera (though not of the same species or subspecies) are found in a more or less continuous population across the Dominion, but *Megabothris abantis* does not appear to occur east of the Rockies! It is extremely local in distribution, being rather rare at low altitudes, especially in dry open country, but quite common in forested areas, especially in the mountains. The factors determining its range cannot be the lack of suitable hosts in adjacent territory, as the mouse situation remains sufficiently constant. Nor does it appear to be excluded by a competitive species. The flea would seem, then, to be directly affected by the only apparent variable, namely, the climate. Probably altitude (barometric pressure), relative humidity and temperature are all contributors to the limitation of its distribution.

Again, there are a number of fleas such as *Amphipsylla* spp., *Malaraeus penicilliger* ssp. and *Monopsyllus thambus*, which apparently are fairly common on mice of various genera across the northlands, but rare or absent in southern Canada, except in the subalpine regions at high altitude in the western mountains, where the climate is subarctic in character.

To cite an example from the bird-fleas—*Dasypsyllus gallinulae perpinnatus* is known only from the Pacific coast of British Columbia, Washington, Oregon, California and Mexico, where it has been taken on a large variety of birds, mostly passerines, no one of which could be termed the specific or true host. As many of these birds, such as juncos, towhees, robins, etc. occur also east of the coast mountains, why has this flea not been recorded from, say, central British Columbia, let alone territories still farther east ? Surely the answer lies in the fact that this flea requires a type of nest (the exact genus or species of the bird host not being important) in country supporting a climate with a relatively high mean humidity, and perhaps certain temperature limits. As the nests of most passerines are open and exposed directly to the atmosphere, it may be quite readily seen that it is possible for the humid atmosphere of the coast to present suitable breeding conditions for these fleas, whereas the dry climate and more extreme temperatures of the interior of British Columbia, even though

Table III

Canadian fleas limited geographically principally by reason of their host specificity

FLEA	TRUE HOST	REMARKS
Hystrichopsylla schefferi *Trichopsylloides oregonensis* *Dolichopsyllus stylosus*	"mountain beaver", *Aplodontia rufa* ssp.	Occasionally taken on predators of mt. beaver; e.g. *Mustela vison* and *Spilogale gracilis*.
Corypsylla ornata *Nearctopsylla jordani*	western moles, *Scapanus* and *Neürotrichus*	Occasionally taken on associated mammals, e.g. *Sorex*, *Microtus*, *Peromyscus*, etc.
Doratopsylla blarinae	short-tailed shrew, *Blarina brevicanda*	Occasionally on *Sorex*, *Parascalops*, etc.
Corrodopsylla curvata ssp.	long-tailed shrews, *Sorex* sp.	Sometimes on *Blarina*. *Neürotrichus Microtus*, etc.
Neopsylla inopina *Opisocrostis t. tuberculatus*	ground squirrels, especially *Citellus r. richardsonii*	Also on *Citellus columbianus* in S.E. Brit. Col. where a more or less continuous ground squirrel population leads thro' mountain passes to *C. richardsonii* on the plains.
Tamiophila grandis	Eastern chipmunks, *Tamias striatus* ssp.	Occasional records on other mammals.
Meringis shannoni	pocket mice, *Perognathus parvus* ssp.	Also on *Peromyscus*, near colonies of *Perognathus* but not elsewhere .
Amphalius necopinus *Ctenophyllus terribilis*	pikas or conies, *Ochotona* spp.	No other records.
Ceratophyllus riparius *Ceratophyllus c. celsus* *Ceratophyllus idius* *Ceratophyllus petrochelidoni*	*Riparia riparia* *Riparia riparia* *Iridoprocne bicolor* *Petrochelidon albifrons*	These fleas appear to be definitely associated with the species of swallows named, although there are too few records available for one to be sure that the fleas occur throughout the breeding range of the birds.
Dactylopsylla comis *Foxella ignota* ssp.	pocket gophers, *Thomomys talpoides* ssp.	Sometimes taken on weasels in pocket gopher country.
Monopsyllus vison *Orchopeas caedens* ssp.	red squirrels, *Tamiasciurus hudsonicus*	Sometimes on weasel and marten.
Monopsyllus ciliatus protinus *Orchopeas nepos*	Douglas chickaree, *Tamiasciurus douglassi*	Sometimes on chipmunks, weasel, mink, marten, spotted skunk.
Monopsyllus e. eumolpi	western chipmunks, *Eutamias* spp.	Rarely on *Tamiasciurus*, *Citellus columbianus*, *Microtus*.
Odontopsyllus dentatus *Cediopsylla* spp.	cottontails, *Sylvilagus* spp.	no other records.
Opisocrostis bruneri	Franklin ground squl. *Citellus franklinii*	Occasional on other *Citellus*.
Opisocrostis labis	Richardson ground squl. *Citellus r. richardsonii*	Very specific. No records from *C. columbianus* (Cf. *Neopsylla inopina* and *Opisocr. tuberculatus*)
Opisodasys pseudarctomys *Opisodasys vesperalis*	flying squirrels, *Glaucomys* spp.	Rarely on *Tamiasciurus*.
Orchopeas howardii	grey squirrels, *Sciurus carolinensis*	Rarely on *Tamiasciurus* and *Glaucomys*.
Orchopeas 6-dentatus agilis	woodrats, *Neotoma cinerea* ssp.	Not infrequently on *Ochotona* when woodrats occupy same rockslides. Also on predators.
Oropsylla arctomys	woodchucks, *Marmota monax* ssp.	Rarely on *Marmota caligata*.
Oropsylla idahoensis	ground squirrels, *Citellus lateralis* and *Citellus columbianus*	common on predators.
Oropsylla rupestris	Richardson ground squl. *Citellus richardsonii*	Occasional on weasels, rats (*Rattus*).
Thrassis acamantis	groundhogs, *Marmota flaviventris avara*	Rarely on other hosts.
Thrassis spenceri	whistlers, *Marmota caligata* ssp.	Sometimes on predators (*Ursus* spp., *Gulo luscus* etc.)
Hoplopsyllus glacialis lynx	varying hare, *Lepus americanus* group	Frequently on predators such as *Lynx canadensis*, *Lynx rufus*, *Vulpes* spp. etc.

the same birds were nesting, would prohibit development. Limitation of distribution of this type thus is almost undoubtedly controlled by factors which affect the flea larva rather than the adult. An adult *Dasypsyllus* could probably exist quite satisfactorily in the relatively stable microclimate of its host's feathers, no matter where the bird chose to live, but the delicate soft-bodied flea larva, exposed to the macroclimate of the outside world would not necessarily find local conditions to be suitable.

The problem of climate influence in the study of flea distribution brings one to the consideration of the complexities of "life zones" in Canada. Anderson (1937) gives an outline of the faunas of Canada based on the broad divisions worked out by Merriam. Halliday (1937) in "A Forest Classification for Canada" gives an outline of climate, soil type and floral divisions for the Dominion which, with a detailed map also provides a convenenient terminology.

The following table summarizes some of the information available at present on Canadian fleas whose distribution appears to be limited by climatic factors.

Table IV

Canadian fleas limited geographically by climatic factors

PREFERRED HOST	FLEA	RANGE IN CANADA
White-footed mice, *Peromyscus* spp.	*Micropsylla sectilis* ssp.	West of Rocky mountains to Pacific coast.
(These mice are among the most cosmopolitan of our native mammals, occuring all across the Dominion and far into the northlands)	*Atyphloceras multidentatus* *Peromyscopsylla h. pacifica*	West of Pacific coast mountains (Cascades) in southern B. C. only.
	Opisodasys keeni *Malaraeus telchinum*	West of Rockies only, to Pacific coast, including islands.
	Orchopeas leucopus	Dominant flea of *Peromyscus* in eastern Canada and the N. W. T. and probably northern B. C. Replaced by other species elsewhere.
	Monopsyllus thambus	Common only in the far north.
	Monopsyllus wagneri ssp.	3 subspecies. Dominant fleas of *Peromyscus* from southern part of Manitoba westward to Pacific.
	Epitedia wenmanni	Common from Atlantic seaboard to parts of B. C. but not west of Cascades. Occurs in N. W. T. Apparently missing from Coast Forest and Columbian Forest Regions.
	Callistopsyllus terinus	Known only from Columbian Forest Region of British Columbia.
	Callistopsyllus campestris	Great Plains Region only.
	Catallagia charlottensis	Common only west of Cascades in B. C.
	Catallagia decipiens	Common from east of Cascades to Saskatchewan, but not east of here.
Microtines (*Microtus, Clethrionomys, Phenacomys*) also *Zapus*	*Malaraeus penicilliger* ssp. *Amphipsylla s. pollionis*	Probably common in the N. W. T. and Yukon, but rare or absent farther south, except at high altitudes in B. C. and Alberta mountains.
(As a group, even more widespread than *Peromyscus*)	*Megabothris abantis*	Common from Rockies to Pacific coast, especially in forested areas and in the mountains.
	Peromyscopsylla selenis	Common in the mountains of B. C. and Alta. Also in the N. W. T., and extending as far east as Manitoba.
	Peromyscopsylla catatina *Stenoponia americana* *Saphiopsylla bishopi*	Eastern Canada only.
	Delotelis telegoni	Rockies to Pacific only. Rare.
Mice and insectivores	*Ctenophthalmus pseudagyrtes*	Common from the Atlantic seaboard to the Rockies, but not west of here.
Woodrats (*Neotoma cinerea* ssp.) (Rockies and westward)	*Peromyscopsylla ravalliensis*	Rare. Usually in areas at fairly high altitude.
Weasels, marten etc. or possibly insectivores	*Nearctopsylla brooksi* *Nearctopsylla hyrtaci*	Western Canada only (B. C., western Alta., and the North).
Columbia ground squl. *Citellus columbianus* (See map 23)	*Thrassis petiolatus*	Common on this ground squirrel except in the mountains where it is replaced by *Oropsylla idahoensis*.
Tamiasciurus spp. *Neotoma* spp. (See maps 17 and 18)	*Megarthroglossus* spp.	Rare. Very local. Western Canada only.
Tamiasciurus and *Glaucomys*	*Tarsopsylla coloradensis*	Rare. Apparently chiefly localized to areas at high altitude, or the northlands.
Black bears (*Euarctos*) and other large carnivores	*Arctopsylla setosa*	Known from British Columbia only.
Passerine birds	*Dasypsyllus gallinulae perpinnatus*	Known only from Coast Forest Region of British Columbia.
Many birds, including poultry	*Ceratophyllus niger*	B. C. only, but east and west of the Cascades.
Many types of birds	*Ceratophyllus garei* *Ceratophyllus diffinis*	Widespread, but very local in distribution.

NOTES ON THE RELATIONSHIP OF NEARCTIC AND PALAEARCTIC FLEAS

As mentioned, the fleas are undoubtedly an ancient group, originating at some unknown time in the geologic past as temporary parasites of archaic small mammals. The most ancient mammal remains have been discovered in Asia which is generally conceded to be the "Mother of Continents" and it is probable that the fleas originated there too, spreading subsequently to other parts of the World during the ensuing ages. The Americas probably received the remote ancestors of some of the modern genera of fleas during the Lower Eocene. During the ensuing periods, great diversification of mammals took place, most strikingly shown in the larger forms, but occurring also in the small, and in their parasites. These mammals were distributed between the "continents" by successive migrations and countermigrations. During the great periods of glaciation, much of the mammal fauna, with its attendant parasite population was exterminated across the northern part of North America. Later, with the gradual receding of the great ice sheets, came a repopulation of what is now Canada by mammals from three principal sources (1) from refugia (areas that were not inundated by ice), (2) from areas lying to the south, by the descendants of the survivors of the glaciation, and (3) from Asia again, with successions of immigrations across the Siberian-Alaskan land bridge, which still remained. As pointed out by Williams (1934), Anderson (1937) and others, the ancestors of most of the familiar North American mammals, and especially those of northern Canada, arrived at this time, when the Bering Straits region was bridged across, or while there was at least a solid ice connection, and these last migrations and countermigrations may have been only a few thousands of years ago. The most important evidence for this contention lies in the striking similarity of certain forms on the two continents today, such as the reindeer, mountain sheep, bears, wolves, otters, wolverines, beaver, hares and pikas as well as many of the smaller forms such as squirrels and mice.

A comparative study of the modern flea fauna of some of these mammals in eastern Asia and northwestern North America gives added proof of this mass immigration of mammals up to the late Pleistocene. It is a noteworthy fact that some North American mammals which are today considered to be congeneric with Asiatic forms are also characteristically infested, in many cases, by the *same genera* of fleas! * It offers interesting data on host specificity also, which in these instances has been maintained at least since Pleistocene times, and probably a great deal longer! Some of the more striking examples are quoted below : *Doratopsylla* and *Corrodopsylla* on *Sorex; Arctopsylla* on *Ursus; Oropsylla* on *Marmota; Amphalius*, *Geusibia* and *Ctenophyllus* on *Ochotona; Amphipsylla*, *Ctenophthalmus*, *Malaraeus* and *Megabothris* on *Microtus; Monopsyllus* and *Tarsopsylla* on *Sciurus; Neopsylla* and *Diamanus* on *Citellus;* and *Hoplopsyllus* on *Lepus*.

Other holarctic genera infest at least corresponding groups, although not necessarily identical genera of hosts in both Old and New Worlds, e.g. *Myodopsylla* on bats; *Hystrichopsylla*, *Stenoponia*, *Peromyscopsylla* (or *Leptopsylla*) and *Ctenophthalmus* on various insectivores, mice etc., and *Dasypsyllus*, *Ceratophyllus* and the arctic *Mioctenopsylla* on birds.

Still other genera, while regarded as strictly nearctic, are so close to holarctic or palaearctic genera as to leave no doubt as to their origin. Here would be

* Wagner (1936) and Jellison and Kohls (1939) have already drawn attention to the striking parallel between some Asiatic and North American fleas.

included *Epitedia* and *Tamiophila* which are obviously from a *Neopsylla*-stock; *Micropsylla*, which is closely allied to the holarctic *Rectofrontia* and the palaearctic *Rhadinopsylla*, and *Cediopsylla* which resembles the Old World *Spilopsyllus* and like that genus, occurs on rabbits.

The genera showing closest affinities to the palaearctic forms occur across the north of Canada. Farther south in Canada and through the United States into Mexico and southwards into South America, purely New World genera appear in increasing numbers and the more typically northern genera tend to become less common. Some of the purely nearctic flea genera infest mammals also known only from the New World—such as *Dolichopsyllus* and *Trichopsylloides* on the "mountain beaver" *(Aplodontia)*. The nearctic pocket gophers *(Thomomys* and *Geomys)* are infested with *Foxella* and *Dactylopsylla*, which, while not represented at all in the Old World, show certain affinities with the holarctic *Oropsylla*. *Meringis* and *Phalacropsylla*, offshoots of *Neopsylla* occur on pocket mice *(Perognathus)* and kangaroo rats *(Dipodomys)*.

There are a few genera, such as *Saphiopsylla*, *Stenoponia* and *Odontopsyllus*, which today are common only to eastern North America and *western* Europe, a peculiar state of affairs, and more difficult to explain, as theories of recent Atlantic connections with the northern continents are now more or less discredited. It may be that these are very ancient genera, of extremely stable character, and formerly of much wider distribution, which were exterminated in western North America and parts of Asia during the glaciations, and that while they have retained their generic identity, have never become re-established over their entire former range. *Atyphloceras*, of western North America is very close to *Saphiopsylla*, but is unknown in Europe or Asia.

ECONOMIC IMPORTANCE OF FLEAS IN CANADA

While the great majority of flea species are parasites of small wild mammals and appear to be of little or no direct economic significance, a few species are of very immediate concern to mankind. These fleas affect us in two principal ways (1) as domestic pests of man and livestock and (2) as potential disease carriers.

1. Domestic and Veterinary infestations of fleas

The following species affect man directly as domestic or livestock pests, and are of economic concern because of their painful bites:

Ctenocephalides canis	—the dog flea
Ctenocephalides felis felis	—the cat flea
Ceratophyllus gallinae	—the European hen flea
Ceratophyllus niger	—the western hen flea
Pulex irritans	—the human flea

All of these, with the exception of *C. niger*, and probably *Pulex irritans*, are considered to be importations from the Old World, where for centuries they have been pests of man, poultry, cats and dogs etc. *Ctenocephalides* and *Pulex* seem to be well known all across the Dominion, especially in large centres of population, and domestic infestations are frequent. *Pulex* is particularly abondant in seaport areas. *C. gallinae*, a pest of poultry, appears to be confined to eastern North America. It is replaced in the west by *C. niger*, an indigenous bird-flea which has adapted itself to domestic conditions and is now a well know pest of hen houses. It bites man viciously.

The human flea and dog and cat fleas thrive best in homes where moderate conditions of dampness exist. The introduction of sawdust burners has increased infestations of *Ctenocephalides* by providing favourable conditions of humidity (in fuel bins) for development of these fleas. *Pulex* sometimes becomes established in lawns or on sea beaches, in sea weed at tide line.

2. Medical importance of fleas

Fleas also assume economic importance because of the ability of certain species to transmit diseases, particularly bubonic or sylvatic plague *(Pasteurella pestis)*. A great deal has been written about plague in the Old World and the New, and the part that fleas play in its transmission. The great majority of native Canadian species is probably of little consequence in this respect, although some are, and others may be, of considerable importance.

To be of economic importance with regard to plague, a flea must (1) be capable, physically and physiologically, of transmitting the disease, (2) be of relatively common occurrence, and (3) include man on its list of preferred hosts, or be a common parasite of a domestic or near-domestic rodent or other animal—or in some way be an agent of transmission of this disease among animals apt to be in contact with man.

While a number of species, mostly of foreign origin, and introduced to this continent, have been thoroughly studied, only a comparatively small number of indigenous species have been investigated. Eskay and Haas (1940), experimented extensively in order to determine which of the commoner California rodent fleas can act as vectors. Prince (1943) has added to the list of experimental vectors. Burroughs (1944) added *Malaraeus telchinum* to the growing list of potential culprits, and pointed out that it is a common species on certain

indigenous California mice as well as on the introduced *Rattus norvegicus*. The writer (Holland, 1944) published a note on some plague-important species of fleas in Canada, based on the findings of these researchers. However, most of the native fleas, including many of the commoner and possibly important species remain unstudied. In addition, the plague-potentialities of most of the native mammals and birds remain unknown.

For many years investigators held the opinion that plague was a recent importation to North America, and that the sylvatic form was to be explained by theoretical contacts between infected domestic rodents (introduced by ships from other countries), and native small mammals, with mutual interchange of ectoparasites. Now Meyer and others incline to the alternate theory that plague has existed in the New World at least since Pleistocene times, and that for centuries past it has probably been a population controlling factor in the native rodent economy.

Much evidence is available to support this latter theory, not the least of which is the fact that the known plague foci in many, if not most instances are discontinuous, being separated by wide gaps, sometimes of hundreds of miles. This is difficult to explain if one adheres to the contention that all plague in native rodents is the result of a progressive infection originating from the San Francisco outbreak at the turn of the century.

Plague in Canada is at present known only from areas in Alberta and Saskatchewan where it has been identified in the common ground squirrel *(Citellus r. richardsonii)*, and its fleas. Some of the fleas infesting this mammal are known to be efficient plague vectors.

Following is a list of the fleas occurring in Canada that are known to be capable of transmitting plague, at least experimentally, and which infest animals that would tend to bring them into close contact with man.

Ctenocephalides canis	on dogs, cats, rabbits, rats
Ctenocephalides felis felis	dogs, cats, rabbits, rats
Leptopsylla segnis	house mice, rats
Malaraeus telchinum	native mice, rats
Monopsyllus eumolpi eumolpi	chipmunks
Nosopsyllus fasciatus	domestic rats
Opisocrostis bruneri	ground squirrels
Opisocrostis labis	ground squirrels
Opisocrostis tuberculatus	ground squirrels
Orchopeas 6-dentatus agilis	woodrats
Oropsylla rupestris	ground squirrels, rats
Pulex irritans	rats, rabbits, hogs
Thrassis acamantis	marmots
Thrassis bacchi	ground squirrels
Xenopsylla cheopis	domestic rats

Some of these may be classed as weak vectors, while others are efficient. Not all will bite man directly. In any case, the list is undoubtedly unrepresentative and incomplete, so that there is room for much work to be done to increase the knowledge of relative infectivity, host specificity and potential importance of indigenous Canadian fleas.

The mechanics and physiology of plague transmission by fleas are well treated by Patton (1931), Wu *et al.* (1936), Eskey and Haas (1940), Ioff (1941) and by Meyer (1947), to which works the reader is referred.

Fleas are also known to be transmitters of endemic typhus and tularaemia, and are important vectors of the dog tapeworm.

NOTES ON ANATOMY, AS APPLIED TO SYSTEMATICS

A basic knowledge of the anatomy of fleas is a necessary adjunct to any consideration of the taxonomy of the order. As the morphology of fleas, with special reference to skeletal structure has recently been treated in considerable detail (Snodgrass, 1946) it is necessary here to give only sufficient notes to outline the subject, and explain the terminology used in the keys, descriptions and illustrations.

The critical characters used in the taxonomy of the Siphonaptera are contained for the most part in structural details of the exoskeleton. This involves the presence, number, position and relative development of certain spines and setae (referred to as bristles in many publications), and the shape of various sclerites, particularly in the modified segments of the abdomen, which form the genitalia. In the females, the form of the receptaculum seminis or spermatheca is also of great importance. As a consequence, fleas may be studied satistorily only when adequately cleared and prepared as microscope slide whole mounts (see Appendix B.) or dissections. The following data pertain especially to Canadian flea fauna.

1. Head

The head capsule of a flea has generally been considered to consist primarily of an anterior "frons" and a posterior "occiput" which regions were regarded as being separated by the antennal fossae. With the exception of an interantennal groove and interantennal ridge which may or may not occur on the top of the head, fleas lack the various sutures which commonly serve to identify the location of the elements of the insect cranium. Snodgrass shows by a study of muscle attachments that the so called frons must be, at least in part, the clypeus, and that a tubercle, set in a notch, and usually referred to as the "frontal tubercle" should in actuality be termed a "clypeal tubercle". This structure is not always present in any case, and its function is not definitely known, although it has been suggested that it serves to rupture the pupal skin. Jordan (1945: 113-116) has demonstrated that in two families (Vermipsyllidae and Ischnopsyllidae) the "frontal tubercle" may be deciduous, and varying amounts of it, from the complete structure to a more or less smooth scar may be preserved in individual specimens of a particular species.

In the present paper, the areas anterior and posterior to the antennal fossae will be referred to as pre- and postantennal regions respectively. As mentioned, these areas may or may not be separated by an interantennal groove (dorsal sulcus of many authors), and the degree of separation varies in different families and genera. Oudemans (1909) and many later students used this character to separate the Siphonaptera into two sub-orders, the Integricipita and Fracticipita (whole-headed and broken-headed fleas) but most students of the order today regard the presence of this groove or "suture" as being of no more than generic value.

Sometimes the inner walls of the antennal fossae are fused, or they may be separate, and connected by a transverse sclerified rod termed the trabecula centralis. When present this is visible as a round dark area situated approximately at the mid-point of the anterior margin of the fossa. Its function is to reinforce the head capsule against lateral pressure. Certain genera (e. g. *Ctenophyllus*)have thin thread-like sclerifications visible in the genal region, partly concealed by the eyes. These represent either the dorsal or anterior arms of the tentorium. These internal structures are used in the identification of certain taxonomic groups.

The antennae, which lie protected in the antennal fossae, but which may be erected at will, especially in the males, consist of three principal parts, (1) the basal segment or scape, (2) the second segment or pedicel and (3) the club or clava, which may be partially or completely divided into nine segments. The pedicel possesses a marginal row of setae which are short in some genera and as long as, or longer than, the club in others. Sometimes sexual dimorphism is evident, in which cases these setae may be short in the male but long in the female. In one Canadian genus *(Callistopsyllus)* part of the pedicel is produced to form a protective sheath around the base of the club (Pl. XVII, fig. 116).

The paired eyes, which are simple (actually ventrally displaced ocelli, according to Snodgrass) may be large and heavily pigmented, reduced, vestigial or even totally absent in different genera. In the keys, eyes which are large and almost circular or oval in outline, and dark with pigment, are regarded as "well developed". Those considered as "poorly developed" or "reduced" usually are smaller, have less pigment, and the ventral margin quite noticeably concave, so that the eye is semi-lunar or bean-shaped. When present, the eye is located below the antennal fossa, just above the cheek or gena. In some fleas with a vertical comb (e. g. *Corypsylla*)an eye vestige may be present high on the head, above the comb.

The gena has a posterior prolongation termed the genal process. Sometimes this process continues around the base of the head, fusing with the occipital margin, in which case the antennal fossa or groove is termed "closed" (family Pulicidae only). Otherwise it is considered "open".

The vestiture and development of setae and spines on the preantennal region are of great taxonomic importance. There is usually a number of more or less well-developed setae which may be located singly or in rows. A single seta located near the eye is termed the ocular seta, and, if it is one of a row of several, the group is known as the ocular row. A row located anteriorly to this is commonly referred to as the frontal row (actually on part of the clypeus ?). Sometimes a number of thickened and pigmented setae (spiniforms) is present along or near the anterior margin of the head. In some genera, the setae of the postantennal region are also arranged in rows. Besides a few pairs of dermal pits or placoids, small punctations are frequently present on the head capsule, especially dorsally. These may contain tiny hairs.

There is very often a comb or ctenidium of heavy pigmented spines on the head. These spines vary in number, shape and position, and are of great importance in taxonomy. Most frequently located along the ventral border of the gena (genal ctenidium) they may be pointed, blunt, spatulate, separate or crossing each other. They may be arranged horizontally, more or less obliquely or even vertically. Sometimes spines occur along the anterior margin of the antennal fossa. In the bat fleas (three genera) they appear as ventral flaps at the anterior end of the head.

The mouthparts are used for piercing skin and sucking blood, and in consequence the elements are elongated and otherwise adapted to this purpose. The labium is channeled on the anterior side and bears a pair of palpi. These labial palpi vary in length and number of (apparent) segments in different genera and species and are thus of importance in flea systematics. Inside the channel of the labium lie three stilettos, which are approximately the same length as the labial palpi in most fleas. These are a median epipharynx (erroneously termed the hypopharynx in many works), and a pair of serrated or denticulate maxillary laciniae (frequently and erroneously referred to as the mandibles). The maxillae bear 4-segmented palpi in addition to the above mentioned laciniae. In lateral aspect, the maxillae themselves are somewhat triangular, being broad at the base and pointed apically, but in two genera of

of bat-fleas they are truncate. The labrum exists as a tiny sclerite just anterior to the base of the epipharynx.

The heads of male fleas are generally smaller, flatter dorsally, and more strongly rounded anteriorly than those of females of the same species. Also, the antennae are longer, and inserted higher up on the frons. Sometimes the antennae are so long that the antennal fossae continue onto the propleura. The heads of the two sexes are much alike with regard to chaetotaxy (cf. figs. 3 and 4).

2. Thorax

The thorax in fleas, as with other insects, is divisible into three segments, the pro-, meso-, and metathorax. Dorsally, each segment bears a single undivided tergum or notum of which the pronotum frequently carries on its posterior margin a comb or ctenidium of heavy spines, termed the pronotal ctenidium. The other nota, in Canadian genera, do not bear combs, but all have one or more rows of setae. In all families but the Pulicidae, there are a few "pseudo-setae" or slender spicules arising from the posterior portion of the mesonotum, *underneath* the collar or flange. The Ceratophyllidae and Ischnopsyllidae have in addition, more or less pigmented apical spinelets located on the margin of the collar of the metanotum, somewhat like the apical spinelets found on the abdominal terga of many fleas (fig. 3).

The sterna and pleura of the thoracic segments have become much fused and modified, and the degree of this fusion between certain elements is sometimes of importance in taxonomy. There has been difference of opinion among students of flea anatomy as to the identity of some of these parts. The writer has followed Snodgrass' work in presenting the following notes.

In the prothorax, the sternal and pleural areas are represented by a single fused sclerite, termed the pleurosternal plate (sternopleura, prosternite of some authors). In some fleas a length-wise ridge may be present, separating dorsally an episternal area and ventrally an epimeral area. There is frequently a sinus on the anterior margin of the pleurosternal plate where the cervical sclerite articulates with it.

The mesopleura and mesosternum are also always united into a single structure, the separate elements of which are usually fairly discernible. In most fleas it is possible to locate an episternal and epimeral area on the mesopleurum by means of an inner vertical rod, attached dorsally and ventrally, and which probably represents a detached pleural ridge. This structure is of importance in classification.

The metanotum bears two transverse sclerified grooves, the anterior of which is the intercostal sulcus, and the posterior, the notal ridge, which usually gives off anteriorly a short longitudinal additional ridge. This merges into an anterior marginal thickening which continues around the ventral edge of the metanotum. In this manner a small area of the metanotum is separated away from the main body of the sclerite. This area has been variously interpreted as a detached portion of the metepisternum or as the episternum itself.

In some fleas (e. g., Pl. I, fig. 1) the notal ridge continues downward and terminates at the upper end of the pleural ridge in what appears to be a ball-and-socket joint. In others the union of notal and pleural ridges is not so complete (e. g., Pl. XV, fig. 97), while sometimes the junction is so complete (Pl. III, fig. 3) that the two ridges appear as one continuous structure. Anterior to the pleural ridge is an episternal area, fusing with the sternum much the same as in the mesothorax. Posterior to the pleural ridge is the huge metipimerum, which overlaps the abdomen and supplants the first abdominal sternite. In one subfamily (Rhadinopsyllinae) the lower lateral surface of the metepimerum bears a heavily striated area (figs. 90, 97, 101) which is used in classification.

This may have some use, along with spinelets or bristles of the hind coxae, as a stridulating mechanism*.

There are two pairs of thoracic spiracles, located as shown in the figures.

While the soft internal parts of the flea are dissolved away by the action of the caustic, there are one or two sclerotized structures which remain. One of these is the lining of the proventriculus, appearing as a ball of spicules, and located usually in the region of the metathorax or anterior part of the abdomen (Pl. II, fig. 2). It is not used in systematics.

3. Legs

Fleas possess three pairs of legs, of which the hind pair is usually greatly enlarged, although all the legs appear to be used when a flea leaps. The legs are composed of the following segments: a large flat coxa, a small trochanter, a large femur, an elongated tibia, and a tarsus of five segments.

The fore coxae are attached at the anterior end of the pleurosternal plate, and hang beneath the head in a transverse plane. Their outer surfaces are well clothed with setae.

The mid and hind coxae articulate with the meso-and meta-thorax in a nearly longitudinal plane, their bases being overlapped slightly by the flange-like lower margins of the episterna and epimera of those segments. These coxae are strengthened by outer and inner longitudinal ridges. The arrangement of setae on the mid and hind coxae and the presence or absence of a row or patch of short spiniform setae (used for stridulation ?) on the inside of the hind coxae is of taxonomic significance.

The trochanter is small in all legs.

The femur is large, and the number of lateral setae on femur I is of importance in classification.

The tibia is elongated, especially in the mid and hind legs, and is variously armed with stiff dorsal and apical setae. Sometimes, as in *Leptopsylla* and *Peromyscopsylla* the dorsal margin has a uniform series of setae, giving much the appearance of a comb.

The relative lengths of certain tarsal segments is sometimes of generic significance. So also is the arrangement of plantar bristles on the terminal segment. There are typically five or six pairs of these, laterally placed, but one or more pairs may be shifted inwards in some genera, or some may be missing. The last tarsal segment terminates in a pair of claws or ungues.

4. Pregenital segments of abdomen

The flea abdomen is now generally considered to consist of ten segments, although some authors have interpreted certain of the small highly specialized sclerites of the terminalia as vestiges of segments XI and possibly even XII.

The first seven, which Snodgrass terms the pregenital segments, are represented by dorsal terga and ventral sterna, which are virtually unmodified. In counting the sterna it must be remembered that the first is missing (or at least membranous, and covered by the metepimerum) and that the first visible ventral abdominal plate is sternum II.

The terga are saddle-like sclerites, each overlapping the one posterior to it, shingle-wise. The number of lateral rows of setae on the terga is of importance; so also is the presence and number of apical spinelets, which represent vestigial ctenidia. In one genus *(Stenoponia)* there is a well developed ctenidium on tergum I (Pl. XI, fig. 55) and terga II—V have extensive series of apical spinelets.

* Enderlein, 1930:771-772, demonstrated that *Pulex irritans* "sings" by manipulating its hind coxae (armed with spinelets) against the finely striated basal abdominal sternum.

One genus of bat-fleas *(Myodopsylla)* bears "false ctenidia" (close groups of heavy setae) on the abdominal terga (Pl. XLI, fig. 338). Another genus (*Eptescopsylla)* has a comb on tergum VII (fig. 335).

Near the dorsal apical margin of tergum VII there is (usually) on each side a group of from one to five conspicuous antepygidial setae. Rarely, tergum VII is produced posteriorly into a lobe or pair of lobes which extend between these groups. Posterior to the antepygidial setae is a sensory plate termed the pygidium or sensilium, which probably represents part of the tenth abdominal segment. Its function is not understood. It is very hairy, and contains a number of circular depressions (trichobothria) each of which contains a long seta. In form the pygidium is usually flat (lateral aspect) but in some genera (Hystrichopsyllidae) it is very convex.

The sterna are the ventral counterparts of the terga. Sterna II-VI are of more or less uniform shape, and with the exception of sternum II, which may bear significant setae, are not much used in taxanomy. The contour of sternum VII is frequently of great specific or subspecific value in the females. It may be entire, or divided by a lateral sinus into upper and lower lobes. The shape of sternum VII is very constant in some species; in others it is highly variable. The diversity of form of this structure probably has some relationship to the shape of the claspers of the corresponding males, and has a function in the mating act.

Abdominal segments I-VII have laterally placed spiracles. The spirally thickened tracheae can usually be traced to these. An occluding apparatus may be seen on the tracheal trunks, separated from the spiracle proper by a tubular atrium. The spiracles of segment VIII open into hairy fossae (stigma cavities of Jordan) on the inner dorsal margins of tergum VIII, on either side of the pygidium. These cavities may be shallow, or very large in different genera.

The remaining abdominal segments will be described with the genitalia of each sex.

5. Male genitalia

The tergum and sternum of segment VIII in male fleas are variously developed in different families and genera. In the Vermipsyllidae these sclerites are virtually unmodified, resembling very much the preceding segments. With most fleas, however, one or both of these plates may be modified to form a more or less protective shield on either side of the external genitalia.

In the bat-fleas (Ischnopsyllidae) both the tergum and the sternum are about equally expanded posteriorly, and, with the aid of strong marginal setae, effectively enclose the genital apparatus. The same situation occurs in three genera of fleas classified here in the Amphipsyllinae *(Amphipsylla, Ctenophyllus* and *Odontopsyllus).*

In some genera of the Hystrichopsyllidae (e.g. *Atyphloceras, Hystrichopsylla, Conorhinopsylla* and *Meringis*) tergum VIII is virtually unmodified, but sternum VIII, while not developed sufficiently to afford much protection to the claspers, may be expanded posteroventrally to a greater or lesser degree, and may have special setae of characteristic form.

With the remainder of the Hystrichopsyllidae (Neopsyllinae, Rhadinopsyllinae, Ctenophthalminae, Anomiopsyllinae, and Nearctopsyllinae), tergum VIII is somewhat reduced, and sternum VIII distinctly expanded dorsally and posteriorly, to a degree sufficient to at least partly enclose the external genitalia.

In the Pulicidae the above trend of development reaches an extreme, and tergum VIII is very much reduced, while the corresponding sternum is huge, and almost completely encloses the terminalia.

In the Ceratophyllinae, the reverse is the case and tergum VIII is a huge sclerite, usually well armed with setae, and effectively protects the genitalia.

Frequently the inner dorsal surface has a spiculose area. Sternum VIII on the other hand is reduced considerably, and in most cases exists as a slender rod which usually bears one or two apical filamentous appendages. In a few cases (as in *Nosopsyllus* and *Malaraeus telchinum*) sternum VIII is reduced to the merest vestige.

Tergum IX of male fleas is always small, and usually exists as a very slender sclerite arched over the abdomen just anterior to the pygidium, and merging on either side into the genital claspers. These claspers are a pair of broad plates, each with a ventrocephalad extension termed the manubrium. In many fleas, tergum IX has a broad apodemal plate extending cephalad above each manubrium and fused with it. Posteriorly each clasper possesses one or more immoveable processes and an articulated or moveable process, usually termed the moveable finger. The shape and vestiture of this structure is of extreme taxonomic importance. There are usually two (0-3) long acetabular setae inserted near the acetabulum or point of articulation. In one family (Pulicidae) there are typically two moveable processes on each side and part of the clasper lobe itself is hinged. Snodgrass (1946:51) cites evidence that convinces him that the claspers of fleas are homologous with the parameres of certain other insects. Unfortunately the term "paramere" is already well-established in taxonomic flea literature with structures which he asserts should be known as aedeagal hooks or crochets.

Sternum IX is usually boomerang-shaped in lateral view, with a pair of vertical or dorsal arms which extend upwards on either side, and a posteriorly projecting ventral arm. In most fleas the ventral arm is bifurcate, and may have ventral and terminal lobes of particular shape, or significant arrangements of setae and spiniforms. The apical portions may be articulated. At the angle of sternum IX, where the elements of the two sides come together, there may be an apodemal rod (apophysis of many authors) extending anteriorly (Ceratophyllidae, Ischnopsyllidae).

The intromittent organ of fleas is a most complex structure and is treated at length by Snodgrass (1946:48-70) so that it is unnecessary to redescribe it here in detail, other than to explain some of the sclerified structures which remain in cleared specimens and which may have taxonomic significance. It is regretable that Snodgrass did not take into account some of Jordan's recent works, which also deal with the structure of the aedeagus (or phallosome). As it is, two different terminologies have resulted.

Extending anteriorly into the abdomen is the large aedeagal apodeme ("plate of the penis" of various authors). Below this are the penis rods ("springs" or "levers" of penis) which in the living insect are contained in the endophallic sac, and are protracted from the aedeagus in the act of copulation. These rods may be short, or long enough to be coiled once or twice. The external aedeagus frequently bears one or a pair of apical hooks or crochets (not parameres) of significant shape.

Certain researches upon the structure of the aedeagus proper, carried out by Major Robert Traub, indicate that considerable phylogenetic significance may be demonstrated by a comparative analysis of the complexities of this organ in various genera. This work, when published will undoubtedly elucidate many problems concerning the scope and relationship of flea families, and will open a whole new field of investigation.

A small capsule-like organ with an internal network of spicules is seen in the vicinity of each basal arm of sternum VIII in males of the *Ceratophyllus*-type. This is known as the "X" organ or "gland of Wagner"; its function is not fully understood.

The dorsal and ventral plates in the vicinity of the anus are regarded as being derived from the tergum and sternum of segment X.

6. Female genitalia

The posterior segments of the females are not so greatly modified. Sternum VII and its taxonomic importance has already been mentioned.

Tergum VIII is very large (much as in males of fleas of the *Ceratophyllus*-type) and obscures the somewhat rudimentary elements of segment IX. Sternum VIII is reduced to a small ventral structure. As with the males, the anal flaps are derived from part of segment X. Attached to the dorsal flap, or anal tergum there is (except in the Vermipsyllidae) a small bristled appendage, the style or stylet.

Some of the internal genital organs are of considerable taxonomic importance. The shape of the highly sclerotized structure known as the spermatheca or receptaculum seminis is particularly significant. It is composed of a dilated portion, the head, which joins a (usually) more constricted portion, the tail or appendix. The proximal end of this may or may not project into the lumen of the head, and at the distal end, there is, in some genera, a small sclerotized papilla or process. The spermatheca connects with the bursal copulatrix by means of a tube, the ductus receptaculi seminis. Sometimes the degree of sclerification in this tube, or in the bursa itself is a critical character in identification.

Ancestrally, fleas apparently had two spermathecae, and in three modern Canadian genera *(Atyphloceras, Saphiopsylla,* and *Hystrichopsylla)* there are two, but in all the remainder there is but one. A small blind duct, the ductus obturatus, leading into the bursa is apparently a vestigial remnant of the second ductus receptaculi seminis. These ducts, and other soft parts are usually difficult to trace out in over-cleared specimens. Rarely, a flea which normally should possess but one spermatheca, will have two (see footnote, p. 71).

THE PROBLEM OF FLEA TAXONOMY

There is at the present time, unfortunately, no general agreement among siphonapterists upon a systematic classification of the fleas. The extreme modification of these insects, due principally to their parasitic mode of life, the meagreness of fossil material, and lack of intermediate forms between some widely separated modern groups (due probably to the dying out of certain mammal families and genera in the recent geological ages) makes their phylogeny difficult to interpret. As Dr. Karl Jordan stated in a letter to the writer, the problem suggests an attempt to assemble a jig-saw puzzle in which many of the more important pieces are missing.

Baker's classifications of 1904-1905 are of course now hopelessly out of date, as the great bulk of the genera and species now known have been discovered since his time. Wagner at various times up to 1939 has published classifications which have much to commend them. Ewing and Fox (1943) published a paper on North American fleas which includes a classification of families and subfamilies intended to accommodate the fleas of the world. Their radically different interpretations of family and other categories have been subjects of much controversy. The synopsis of families, subfamilies and genera listed by Jellison and Good (Index to the Literature of Siphonaptera of North America, 1942:3-4) groups related genera with but few exceptions, but some of the subfamilies do not appear to be well placed. It is evident now that the arrangement is not entirely satisfactory, and Dr. Jellison has informed the writer that his own views on the location of certain families and genera have changed since the publication of the "Index". Hubbard's recent monographic work (1947) rearranges many of the genera in a different way again, but unfortunately the changes are not supported by adequate revisions of family diagnoses, so that some of his opinions appear illogical to the present writer. Dampf's (1945) limitation of the subfamily Dolichopsyllinae to contain only the aberrant genus *Dolichopsyllus*, and the erection of the subfamily Amphipsyllinae to accommodate certain other genera not closely allied to the *Ceratophyllus*-type, are, to the writer's mind, steps in the right direction. Still, it is apparent that there has not yet appeared a satisfactory natural classification of the fleas of North America, nor, for that matter, of the world.

It is now evident that many of the important and significant structures denoting relationship may be relatively obscure. Some of the more striking characteristics, such as the presence or absence of ctenidia, eyes, and dorsal "sulcus" are of comparatively little importance, and rarely of more than generic value. Some writers have laid great stress on the "frontal tubercle" and, on the presence or absence of that structure, have separated genera into positions systematically remote, when a study of genital and other characters indicates that these genera are actually closely allied.

The pattern of the male genitalia; details of the antennae; structure of the thorax; the internal skeletal structure of the head capsule (trabeculae and tentorial arms); presence or absence of female stylet; relative development of the elements of abdominal segment VIII of the males: these are among the many characters that have been neglected by some recent workers, and which frequently bear great fundamental significance.

In the writer's opinion, only men who have facilities for studying and comparing fleas from all parts of the world are in a position to pronounce authoritative judgment upon the scope of families and relationship of genera. Dr. Jordan, with his years of experience and access to the huge Tring collections

occupies a unique position in this connection, and it is hoped by all students of the order that he will be able to publish a monograph of the fleas of the world.

The primary purpose of the present paper is to provide a means for the identification of Canadian fleas, together with some observations on their geographical ranges and host relationships, rather than to revise the taxonomy of the order. None the less, the writer does not feel that he can subscribe fully to any classification that has yet appeared. Dr. Jordan has been particularly kind in allowing the use of some of his unpublished ideas, and the classification to follow will be based to a considerable extent on these. The writer hopes that the discussions and definitions of the categories used will warrant the departure from arrangements adopted in recent works, and that they will help to clarify these difficult problems rather than add to the confusion already existing.

It should be clearly understood that the definitions of families and subfamilies given here apply to holarctic and nearctic genera only, as a number of genera, from other parts of the world, but belonging to these groups, differ in various respects, so that, if they were to be included, certain limitations of the diagnoses would be necessitated.

Seven families of fleas (as here considered) occur in North America. Two of these, Tungidae and Malacopsyllidae, are not known from Canada. Of the five families occurring in this country, the Pulicidae is well set off from the others, having a number of very special modifications. The members of the small family Vermipsyllidae, too, are readily distinguished from all other fleas, having certain peculiar adaptations or combinations of characters not found elsewhere. Of the three remaining families, the Ischnopsyllidae have special characters, relating particularly to the head capsule. In addition, this family is strictly associated with the bats (Chiroptera). However, in many ways, these fleas are generalized and not far removed from the Leptopsyllinae, a subfamily placed here in the Ceratophyllidae.

In recent literature there has been very little concurrence of opinion on the scope of the Ceratophyllidae (or Dolichopsyllidae) and the Hystrichopsyllidae. This, to a considerable extent, has been due to difference of opinion as to the fundamental significance of the fracticipit head as opposed to the integricipit type. As mentioned elsewhere, many genera are intermediate in this respect. Furthermore, others are proved to be close relatives by other characters, although one may be broken-headed while the other has the head capsule entire (as *Stenistomera* and *Callistopsyllus*). The characters used here to separate Hystrichopsyllidae and Ceratophyllidae pertain particularly to the terminal abdominal segments of the male, and the thorax. In addition, the former family tends to have more ctenidia, but there are many exceptions.

NOTES ON THE ILLUSTRATIONS

As space in this paper does not permit of complete redescriptions of each individual species, conclusions drawn from a study of the keys and notes must be checked against the illustrations which show the more important diagnostic structures.

The figures are plain line drawings, made with the aid of a camera lucida. Except where otherwise stated, or where illustrations are copied from previous works, all these drawings are made to the same scale (approximately X 93), so that some idea may be had of the relative sizes of corresponding structures in various genera and species of fleas. All drawings are prepared from the left lateral aspect. Internal thicknesses and underlying structures are usually represented by dotted lines, and sometimes by stippling. When eyes are well developed and heavily pigmented they are indicated in solid black. When reduced or vestigial, they are not shaded, but represented in plain or dotted outline. The drawings of the heads do not as a rule include the antennae or mouthparts except where these are specially mentioned in the keys. Setae (=bristles of many authors) are usually unshaded. True spines such as those frequently on the head and pronotum and sometimes the abdomen are represented in solid black. So also are the pigmented spiniforms and heavy setae sometimes to be found on the male genitalia and other parts of the body.

In comparing specimens with the drawings, it must be remembered that a certain degree of variation is allowable. In some highly variable structures as the sternum VII (♀) of some species, several examples may be illustrated. Fleas lend themselves far more readily to illustration than to verbal description.

GLOSSARY OF ABBREVIATIONS USED IN THE KEYS AND ILLUSTRATIONS

Abd.	abdomen; abdominal
Ac.	acetabulum; acetabular
Aed.	aedeagus; aedeagal
An.	anus
Ant.	antenna
Ant.F.	antennal fossa
Antp.S.	antepygidial setae
Ap.	apodeme; apodemal
B.cop.	bursa copulatrix
Cl.	clasper lobe
Clp.	clypeus
Clp.T.	clypeal tubercle
Clv.	clava
Coll.	collar of spermatheca
Crc.	crochet of aedeagus ("paramere")
C.Scl.	cervical sclerite
Ct.	ctenidium
Cx.	coxa
D.o.	ductus obturatus
D.P.	dermal pits
D.r.s.	ductus receptaculi seminis
Ephy.	epipharynx
Epm.	epimerum
Eps.	episternum
F.	moveable process(es) of clasper
Fm.	femur
Fr.	frons; frontal
G.	gena; genal
Gl.W.	gland of Wagner
G.P.	genal process
Intc.S.	intercostal sulcus
Int.G.	interantennal groove
Int.R.	Interantennal ridge
L.	labium; labial
Lc.	lacinia
Lb.	lobe
Lbr.	labrum
M.	manubrium of clasper
Mb.	membranous appendage
Ms.	meso—pertaining to thoracic segment II
Mt.	meta—pertaining to thoracic segment III
Mx.	maxilla; maxillary
N.	notum; notal (of thorax)
N.R.	notal ridge
Oc.	eye; ocular
P.	immoveable process(es) of clasper
Pd.	pedicel of antenna
Pl.	pleurum
Plp.	palpus
Pl.R.	pleural ridge
Pl.St.	pleurosternal plate
Pn.	penis
Pr.	pro—pertaining to thoracic segment I
Ps.S.	pseudosetae
Pvt.	proventriculus
Pyg.	pygidium
Rd.	rod(s)
R.s.	spermatheca or receptaculum seminis
S.	seta(e)
Sc.	scape of antenna
Sn.	sinus
Spf.	spiniforms
Spic.	spiculose area of tergum VIII (♂)
Spl.	apical spinelets
Spr.	spiracle
St.	sternum
Stig.	stigma cavity of tergum VIII
Stl.	anal stylet
Str.	striated area of metepimerum or sternum II
T.	abdominal tergum; tergal
Tb.	tibia
T.C.	trabecula centralis
Tent.	tentorial arms
Th.	thorax, thoracic
Tr.	trochanter
Ts.	tarsal segments
Ts.S.	plantar bristles of tarsus V
Un.	unguis
I, II, III, IV, etc.	segmental numbers

Note: In the locality records of the various species discussed, the political divisions (provinces, territories) and larger islands of the Dominion of Canada will be indicated by the following abbreviations:

B.C.	British Columbia	N.S.	Nova Scotia
Alta.	Alberta	P.E.I.	Prince Edward Island
Sask.	Saskatchewan	Y.T.	Yukon Territory
Man.	Manitoba	N.W.T.	Northwest Territories
Ont.	Ontario	V.I.	Vancouver Island (B.C.)
Que.	Quebec	Q.C.I.	Queen Charlotte Islands (B.C.)
N.B.	New Brunswick		

KEY TO THE GENERA OF CANADIAN FLEAS

As the families and subfamilies of fleas are defined by complex combinations of characters rather than by single peculiarities, a natural key separating the various categories of necessity becomes very lengthy and involved in order to be reliable. Even then, some of the fundamental characteristics are relatively obscure and not easily identifiable by the beginner, or sometimes may be difficult to interpret in individual specimens, which are damaged or not well prepared. From the standpoint of identification only, an artificial key, separating genera by means of more readily discernible characters,is far more satisfactory. Accordingly, the following key is designed to facilitate accurate generic assignment of specimens, without attempting to demonstrate phylogenetic relationships.

1	With pronotal ctenidium	4
	Without pronotal ctenidium	2
2 (1)	With one row of setae on abdominal terga II-VI. Antepygidial setae present	3
	Anterior abdominal terga each with two rows of setae. Antepygidial setae lacking Abdomens of ♀♀ sometimes considerably expanded (fig. 32) g. *Arctopsylla*, p.	69
3 (2)	Pleural ridge present in mesothorax (fig. 26). On *Rattus* g. *Xenopsylla*, p.	67
	Mesothorax lacking pleural ridge (fig. 23) g. *Pulex*, p.	66
4 (1)	With genal ctenidium	5
	Without genal ctenidium	24
5 (1)	Abdominal tergum I with well developed ctenidium (fig. 55) g. *Stenoponia*, p.	78
	Abdominal tergum I without ctenidium	6
6 (5)	Anterior abdominal terga each with one row of setae	7
	Anterior terga with two or more rows of setae	9
7 (6)	Anterior abdominal terga with heavy sclerotizations. Apical spinelets present (fig. 137) g. *Corypsylla*, p.	103
	Terga without sclerotizations or apical spinelets	8
8 (7)	Genal ctenidium more or less horizontal, with sharp, slightly curved spines (fig. 11). On cats, dogs, and wild carnivores g. *Ctenocephalides*, p.	64
	Genal ctenidium oblique, with blunt spines (fig. 7). On native Leporidae g. *Cediopsylla*, p.	60
9 (6)	Genal spines represented as two flaps, located at anterior end of head (figs. 334, 337, 345). On bats or in bat roosts, caves, etc	10
	Genal spines variable in form and number, but not as above. Not on bats	12
10 (9)	Maxillae acuminate. Head pointed anteriorly (fig. 334). Tergum VII distinguished by strong "false comb" (fig. 335) g. *Eptescopsylla*, p.	179
	Maxillae truncate; head more rounded (figs. 337, 345). Terga I-VII much alike with regard to vestiture	11

11(10) Abdominal terga I-VII with false combs (fig. 338). g. *Myodopsylla*, p. 180

Terga without false combs, but with a few apical spinelets (fig. 346) . . . . g. *Myodopsylloides*, p. 181

12 (9) Metepimerum bearing densely striated area (figs. 90, 97). Head not divided above antennal fossae. Males lacking antepygidial setae . . 13

Metepimerum not as above. Head more or less divided above antennal fossae. Males with antepygidial setae 14

13(12) Lower portion of metanotum divided by a transverse ridge (fig. 97) . . . . g. *Rectofrontia*, p. 91

Metanotum not divided as above (fig. 90). Chaetotaxy of head similar to above (figs. 89, 94) . . . . g. *Micropsylla*, p. 89

14(12) Genal ctenidium of more than two spines 19

Genal ctenidium of two spines only 15

15(14) Genal spines separate, not overlapping. Head "helmet shaped" (fig. 316) . . . . g. *Peromyscopsylla*, p. 175

Genal spines overlapping each other. Head not "helmet shaped" (example, fig. 71) 16

16(15) Tarsus V of some or all of the legs with the basal pair of plantar bristles moved subventrally (fig. 85). Row or patch of spiniforms on inside of hind coxae 17

All plantar bristles lateral. Spiniforms of hind coxae reduced to slender hairs 18

17(16) All tarsi V with four lateral pairs of plantar bristles and a basal submedian pair. No clypeal tubercle (fig. 84). Pygidium flat. g. *Meringis*, p. 88

Pro- and mesotarsi as above. Metatarsus with four lateral pairs only; no basal submedian bristles. Clypeal tubercle present (fig. 71). Pygidium convex . . . . g. *Epitedia*, p. 83

18(16) Basal abdominal sternum ventrally margined with setae. Large fleas (usually over 4 mm.). On eastern chipmunks *(Tamias)* g. *Tamiophila*, p. 88

Basal abdominal sternum without ventral setae. Medium size (under 3 mm.). On *Citellus* spp . . . . g. *Neopsylla*, p. 86

19(14) Genal ctenidium of three spines (fig. 104). Apical segment of labial palpus with hook-like seta (fig. 105) . . . . g. *Ctenophthalmus*, p. 93

Genal ctenidium of more than three spines. Labial palpus not as above 20

20(19) Genal ctenidium of four spines 21

Genal ctenidium of more than four spines 23

21(20) Two spiniforms near frontal angle. Genal spines arranged vertically (fig. 312) . . . . g. *Leptopsylla*, p. 174

No spiniforms. Genal spines arranged horizontally along ventral margin of head 22

22(21) Genal process visible above last spine (fig. 111). Tergum VII with a pair of processes extending posteriorly between the two sets of antepygidial setae (fig. 112) . . . . g. *Corrodopsylla*, p. 95

Last genal spine nearly concealing genal process (fig. 108). No processes on tergum VII . . . . g. *Doratopsylla*, p. 94

23(20) Genal spines five or more, long and slender, and in an oblique row (fig. 42). Females with two equal spermathecae. Large to huge fleas . . . . g. *Hystrichopsylla*, p. 73
Genal spines five, spatulate, and arranged vertically (fig. 140). Single spermatheca. Medium sized fleas . . . . . . g. *Nearctopsylla*, p. 104

24 (4) Anterior abdominal terga each with but one row of setae 25
Anterior terga each with two or more rows of setae 27

25(24) Eyes well developed (fig. 18). Abdominal terga lacking apical spinelets . . . . g. *Hoplopsyllus*, p. 61
Eyes vestigial. Apical spinelets present 26

26(25) Labial palpus 4-segmented. Pedicel of antenna forming a sheath around base of clava (fig. 116) . . . . g. *Callistopsyllus*, p. 96
Labial palpus 5-segmented. Pedicel of antenna not as above (fig. 122) . . . . g. *Megarthroglossus*, p. 98

27(24) Metepimerum with densely striated area (fig. 101). Males lacking antepygidial setae. On *Aplodontia* . . . . g. *Trichopsylloides*, p. 92
Metepimerum not as above. Males with antepygidial setae 28

28(27) Trabecula centralis visible as a pigmented elliptical or circular area in head capsule near anterior margin of antennal fossa, above eye (examples: figs. 3, 4) 34
Trabecula centralis lacking 29

29(28) Postantennal setae fairly numerous, and arranged in oblique rows. 30
Postantennal setae reduced in number, and not in oblique rows (fig. 134) . . . . g. *Conorhinopsylla*, p. 101

30(29) Patch of spiniforms on inside of hind coxa 31
Hind coxae lacking spiniforms 32

31(30) Preantennal region with two rows of setae (fig. 59). Labial palpus not reaching apex of fore coxa . . . . g. *Catallagia*, p. 79
Preantennal region with three rows of setae (fig. 68). Labial palpus as long as fore coxa . . . . g. *Delotelis*, p. 82

32(30) Pygidium convex. Numerous apical spinelets on abdominal terga. Females with two equal spermathecae 33
Pygidium flat. A few spinelets on anterior abdominal terga. Females with single spermatheca . . . . g. *Amphipsylla*, p. 108

33(32) Clypeal tubercle situated very low down, near oral margin (fig. 38). Western North America only . . . . g. *Atyphloceras*, p. 72
Clypeal tubercle situated higher up (fig. 35). Eastern North America . . . . g. *Saphiopsylla*, p. 71

34(28) Eyes vestigial, unpigmented 35
Eyes of medium to large size; pigmented 37

35(34) Sclerified tentorial arm clearly visible in genal region (fig. 166). On *Aplodontia* . . . . g. *Dolichopsyllus*, p. 111
Tentorial arms lacking (figs. 193, 198). On *Thomomys* 36

36(35) Hindtibia with more than 20 stout bristles on posterior and apical margins (fig. 194). First pair of plantar bristles on all tarsi V distally bent downwards and inwards . . . . g. *Dactylopsylla*, p. 124

Hindtibia with less than 20 stout bristles (fig. 199). Plantar bristles all lateral . . . . g. *Foxella*, p. 125

37(34) Hind coxae with patch of spiniforms or hairs 38
Hind coxae without spiniforms 39

38(37) Preantennal region with row of pigmented spiniforms (figs. 158, 160). On *Ochotona* . . . . g. *Ctenophyllus*, p. 109
Preantennal region without spiniforms (fig. 162). On *Sylvilagus* and *Lepus* . . . . g. *Odontopsyllus*, p. 110

39(37) One or no lateral seta on fore femur (Jordan's "group A") 40
A number of lateral setae on fore femur 42

40(39) Segment I of hind tarsus longer than II-IV together (fig. 238) . . . . g. *Tarsopsylla*, p. 143
Segment I shorter than II-IV 41

41(40) ♂. F with 4 or 5 short equal spiniforms, directed upwards (fig. 221)
♀. Ventral margin of anal sternum distinctly angulate near middle. Stylet not curved (fig. 222) . . . . g. *Orchopeas*, p. 135
♂. F with 2 or 3 medium to long, unequal spiniforms, directed downwards or distad (figs. 214, 216, 218)
♀. Ventral margin of anal sternum not angulate. Stylet somewhat curved (fig. 219) . . . . g. *Opisodasys*, p. 131

42(39) Anterior inner lateral surface of mid- and hind coxae with long thin setae from base to apex, aside from those fringing the anterior margin of coxa (Jordan's "group B") 43
Basal part of mid- and hind coxae with no setae except those along the anterior margin (Jordan's "group C") 46

43(42) ♂. F with long posteroventral arm (fig. 190)
♀. Stylet with numerous apical bristles (fig. 192). Head and tail of spermatheca not well differentiated (fig. 191). On *Ochotona* . . . . g. *Amphalius*, p. 123
♂. F without such appendages
♀. Stylet with one long apical bristle. Head and tail of spermatheca well defined. On *Citellus* and *Marmota* 44

44(43) Basal abdominal sternum with patch of lateral setae g. *Opisocrostis*, p. 126
Basal abdominal sternum without patch of lateral setae 45

45(44) ♂. Sternum VIII not reduced to a slender rod (figs. 181, 187).
♀. Head of spermatheca broader than long (Plate XXIV) . . . . g. *Thrassis*, p. 118
♂. Sternum VIII a narrow rod, with apical setae (fig. 178)
♀. Head of spermatheca pyriform, or ovate, longer than broad (Plate XXIII) . . . . g. *Oropsylla*, p. 112

46(42) Third pair of plantar bristles on all tarsi V shifted ventrally (fig. 264) . . . . g. *Dasypsyllus*, p. 150
Plantar bristles all lateral 47

47(46) Stigma of tergum VIII much enlarged (examples, Plates XXXV, XXXVI) . . . . g. *Megabothris*, p. 156
Stigma "normal" 48

48(47) Total of 24 or more spines in pronotal ctenidium (fig. 240). Usually on birds . . . . g. *Ceratophyllus*, p. 145
Less than 24 spines in pronotal ctenidium. On mammals 49

49(48) Eye somewhat reduced, its longest diameter shorter or barely as long as distance from eye to heavily incrassate protion of genal lobe (fig. 273) . . . . g. *Malaraeus*, p. 151
Longest diameter of eye greater than this distance 50

50(49) ♂. Sternum VIII vestigial, without setae (fig. 310)
♀. Tail of spermatheca rolled about head. Apex of bursa copulatrix rolled up as a spiral (fig. 311). On *Rattus* g. *Nosopsyllus*, p. 172
♂. Sternum VIII a narrow horizontal sclerite, with setae, and with or without an apical membranous appendage (fig. 1).
♀. Tail of spermatheca not rolled about head, and apex of bursa copulatrix not as above. Usually on squirrels, chipmunks, mice . . . . g. *Monopsyllus*, p. 164

Order SIPHONAPTERA Latreille 1825

Apterous, laterally compressed insects. Small (1-8.5 mm., average approximately 2-4 mm.). Adults parasitic upon small mammals and birds. Simple eyes, present or absent. Mouthparts modified for piercing and sucking. Antennae short and located in fossae. Thoracic segments free. Tarsi 5-jointed. Coxae very large. Metamorphosis complete. Larvae eruciform, apodous. Pupae exarate and enclosed in cocoons. For further details insofar as Canadian Siphonaptera are concerned, consult sections on Life History (p. 19) and Anatomy (p. 39).

Wagner (1939) recognized ten families of the Siphonaptera (Aphaniptera) of the World, but, as mentioned elsewhere, there is no general agreement as yet as to the number and scope of the families in this order of insects.

Jellison and Good (1942) list seven families for North America. Ewing and Fox (1943) recognize but five, having reduced the remaining two to the status of subfamilies. In addition, the genera are shifted somewhat. Hubbard (1947) also gives but five families for North America.

As here considered, there are seven valid families of Siphonaptera represented in North America. Five of these occur in Canada. The reader is referred to Jellison and Good (1942:5-15) for the synonymy of the order, families and subfamilies up to July 1, 1939.

Family 1. PULICIDAE Stephens 1829.

Eyes large and well pigmented in Canadian genera. Vestiture of preantennal region reduced to two (rarely three) setae of the ocular row, one located near the eye, the other near the oral margin. Interantennal sclerotized suture present or absent. Antennal fossae "closed". Segments of clava of antenna more or less fused on the anterior (ventral in retracted position) side. Mouthparts well developed. Genal ctenidium present or absent. Clypeal tubercle absent, or represented as an angle on anterior part of head capsule. Trabecula centralis lacking.

Pronotal ctenidium present or absent. Mesonotum without pseudosetae under the collar. Metepimerum extending far upward, with the spiracle far above the level of the metepisternum. Metanotum and abdominal terga without apical spines. Abdominal terga II-VII with at most one row of setae. Antepygidial setae present in both sexes. Patch of small spiniform setae on inside of hind coxae. Mid coxae without vertical sclerotized ridge from central articulation downward. Four pairs of lateral plantar bristles.

Males normally with two moveable processes to the clasper, and part of the clasper lobe (P) hinged also. Tergum VIII somewhat reduced, but sternum VIII usually greatly expanded, enclosing the external genitalia. Sternum IX without apodemal rod.

Females with single spermatheca. Stylet present.

All these fleas have the abdomen proportionally shorter and deeper than is usual with those of other families. Most of the species are vigorous jumpers, and will bite man viciously. The family contains a number of genera of extreme economic importance.

Ewing and Fox (1943:101-119) present a very different interpretation of the family Pulicidae to any other that has yet appeared. They include *Anomiopsyllus*, *Callistopsyllus* and *Megarthroglossus*, genera considered as belonging to the subfamily *Anomiopsyllinae* (fam. Hystrichopsyllidae) in the present paper.

Wagner (1939:63-67) gives three subfamilies, and allocates the genera somewhat differently.

The subfamilies (2) are given here as listed by Jellison and Good (1942:4) with the exception of the location of the genus *Hoplopsyllus* which appears to be misplaced.

Sub-family A. SPILOPSYLLINAE Oudemans 1909.

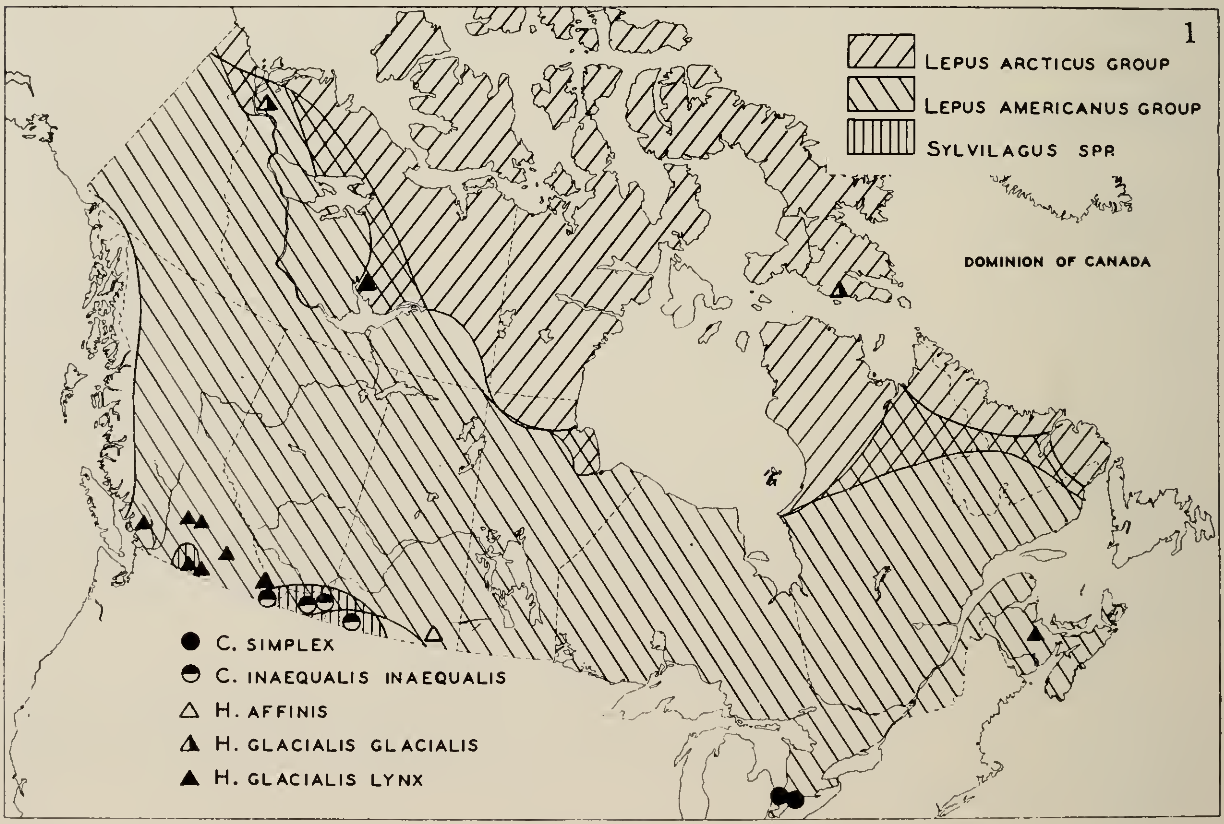
With the characters listed for the family, but distinguished from other Pulicidae by the club of the antenna, which is uniformly elliptical, and with the divisions of the segments visible all around. The subfamily appears to be genetically associated with the Leporidae, although a group including *Actenopsylla* Jordan and Rothschild 1923 (from California) and *Ornithopsylla* Rothschild 1908 (from Europe) have transferred their attention to certain sea-birds which nest in burrows.

Two genera occur on Leporidae in North America. Both of these are known from Canada.

CEDIOPSYLLA Jordan

Genotype: *Pulex simplex* Baker 1895.
Cediopsylla Jordan 1925, Nov. Zool. 32:103.
Cediopsylla Jordan. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:109-110.

Head somewhat angulate anteriorly. Genal comb nearly vertical, and of five or more heavy blunt spines. Labial palpus 4-segmented. Maxillary laciniae large and heavily serrated. Pronotal ctenidium present.



MAP 1

Pulicidae:Spilopsyllinae. Locality records of *Cediopsylla simplex* (Baker) and *C. inaequalis inaequalis* (Baker), (superimposed on the ranges of cottontails, *Sylvilagus* spp., modified after Nelson 1909) and *Hoplopsyllus affinis* (Baker), *H. glacialis lynx* (Baker) and *H. glacialis glacialis* (Taschenberg), (superimposed on the ranges of varying hares, *Lepus americanus* group and arctic hares, *Lepus arcticus* group, after Nelson, 1909).

Two moveable processes distinct on male claspers; also dorsal part of clasper lobe articulated, and extending posteriorly and fringed with setae, and having one short pigmented apical spine. Posteroventral part of clasper produced as a lobe, fringed with setae (figs. 8, 10).

Nearctic and neotropical, replacing *Spilopsyllus* Baker in the Old World, and, like that genus, infesting rabbits. Two North American species are recognized. One of these, *C. inaequalis* is represented by two subspecies, one of which occurs in Canada. This species has been allocated to a new subgenus, *Acediopsylla* by Ewing (1940:37) on the basis of the structure of the maxillary laciniae and the male genitalia.

Key to the Canadian species of *Cediopsylla*

1. Maxillary laciniae not reaching apex of coxa I. Genal ctenidium of about 8 spines. . . . *simplex*
   Maxillary laciniae reaching beyond apex of coxa I. Genal ctenidium of 5 or 6 spines. . . . *inaequalis inaequalis*

CEDIOPSYLLA INAEQUALIS INAEQUALIS (Baker)

(Plate V, figs. 8, 9; Map 1)

Pulex inaequalis Baker 1895, Can. Ent. 27:163-164. Both sexes from "cottontails" (*Sylvilagus* sp.) and "Jackrabbits" (*Lepus* sp.) near Grand Canyon, Arizona.

Cediopsylla inaequalis inaequalis (Baker). Kohls 1940, Nat. Inst. Hlth. Bul. 175:7-11; map 5; pl. I.B.

Cediopsylla inaequalis inaequalis (Baker). Holland 1941, Ent. Soc. B. C. Proc. 37:10. Recorded from Waterton Lakes, Alberta. ex *Sylvilagus nuttalli* ssp.

Cediopsylla inaequalis inaequalis (Baker). Brown 1944, Ent. Soc. Amer. Ann. 37:208. Recorded from Orion, Alta, ex Jack-rabbit (*Lepus* sp.).

While not yet recorded, it is highly probable that this flea occurs on *Sylvilagus* in southern British Columbia. Its distribution appears to be closely associated with the cottontail rabbits of the *Sylvilagus nuttalli* group.

New Canadian records:

Alta.: Elkwater, 18.VII.38, ex *Sylvilagus nuttalli grangeri*, 2♂, 2♀ (G.P.H.). 6.VI.40, ex *S. n. grangeri*, 1♂, 2♀ (G.P.H.)

Sask.: Climax, V.46, ex *Sylvilagus* sp. 4♂, 5♀ (J.C.)

Specimens examined: 14♂, 20♀, including the types (U. S. N. M.)

CEDIOPSYLLA SIMPLEX (Baker)

(Plate V, figs. 7, 10; Map. 1)

Pulex inaequalis var. *simplex* Baker 1895, Can. Ent. 27:164. From Michigan, ex "*Lepus*".

Ctenocephalus simplex (Baker). Baker 1904, U. S. Nat. Mus. Proc. 27:384,385,439. Michigan and Iowa, ex "*Lepus floridanus*" (*Sylvilagus f.*).

Cediopsylla simplex (Baker). Jordan 1925, Nov. Zool. 32:103.

Cediopsylla simplex (Baker). I. Fox 1940, Fleas of Eastern U. S. 21-24; pl. III, figs. 6,7,10. Redescription of the species.

C. simplex is a common parasite of *Sylvilagus* throughtout the eastern United States, being especially associated with *S. floridanus* ssp. It is recorded now for the first time, from Canada.

New Canadian records:

Ont.: Chatham, II.40, ex European hare, 1♂ (G.M.S.)
Electric, 24.I.44, ex *Sylvilagus floridanus mearnsi*, 1♂ (G.M.S.)

Specimens examined: 5♂, 4♀, including the type ♂ (U. S. N. M.)

HOPLOPSYLLUS Baker

Genotype: *Pulex anomalus* Baker 1904.

Hoplopsyllus Baker 1905, U. S. Nat. Mus. Proc. 29:128,130,144.

Hoplopsyllus Baker. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:105-107.

No genal ctenidium. Labial palpus 4-segmented. Eyes large, round and heavily pigmented.

Pronotal ctenidium present, the spines confined to the dorsal part of the sclerite, not extending to the lower margins (Pl. VI, fig. 18).

Occurring in the Old and New Worlds, most of the species infesting rabbits and hares. One species, the genotype, not known from Canada, infests ground squirrels. As this species possesses a number of characters, especially in the male genitalia that set it apart from its congeners, Ewing (1940:37) has, with some justification placed it in a subgenus (*Hoplopsyllus*) by itself. The remaining species and subspecies (five in North America) he places in a subgenus *Euhoplopsyllus.*

The male claspers of the subgenus *Hoplopsyllus* have an articulated section extending posteriorly. As in *Cediopsylla,* this is marginally fringed with setae, and has a small pigmented apical spine. Below this, there are two moveable processes, of which the anterior is vestigial.

In the subgenus *Euhoplopsyllus,* the shape of the articulated portion of the clasper lobe has become much modified, being formed somewhat like the letter "U", and armed on the apex of the anterior arm with a group of strong setae and on the posterior arm with a few setae and a blunt pigmented spine which almost certainly is homologous with the small pigmented spine found in the subgenus *Hoplopsyllus* and the genus *Cediopsylla.* The anterior moveable process has been lost, but the posterior one persists (figs. 19, 21).

Two species of *Hoplopsyllus* (*Euhoplopsyllus*) are known from Canada. One of these is believed to exist as two subspecies.

Key to the Canadian species of *Hoplopsyllus*

1. ♂. Posterior arm of spined and bristled process of clasper about equal in length to anterior arm (Pl. VI, fig. 19)
   ♀. Head of spermatheca subglobular, as broad as long (fig. 20) .... *affinis*
   ♂. Posterior arm of process distinctly longer than anterior arm (fig. 21)
   ♀. Head of spermatheca elongate, and merging more or less imperceptibly into tail (fig. 22) .... *glacialis* ssp.—2
2. See discussion of the subspecies of *glacialis* in the text.

HOPLOPSYLLUS AFFINIS (Baker)

(Plate VI, figs. 18, 19, 20; Map 1)

Pulex affinis Baker 1904, U. S. Nat. Mus. Proc. 27:378,382-383,435. Both sexes from Grand Canyon, Arizona, ex *Lepus.*

Hoplopsyllus affinis (Baker). Baker 1905, U. S. Nat. Mus. Proc. 29:130,144.

Hoplopsyllus affinis (Baker). I. Fox 1940, Fleas of Eastern U. S., pp. 14, 15, pl. IV, figs. 12,14,15. Redescription of the species.

Hoplopsyllus affinis (Baker). Kohls 1940, Nat. Inst. Hlth. Bul. 175:15-17; map 6; pl. II, figs. C, D, G, J.

This species, well known from both *Lepus* and *Sylvilagus* in all the mid-western states from Minnesota to Idaho, and south to Arizona and Texas, is now recorded for the first time from Canada. Its range will probably be found to be restricted to the southern prairies of Alberta, Saskatchewan and Manitoba.

New Canadian records:

Sask.: Estevan, 16.VI.44, ex *Lepus* sp., 5♂, 13♀ (W.F.). 15.VII.44, ex *Lepus* sp., 2♀ (W.F.)

Specimens examined: 6♂, 16♀, including the types (U. S. N. M.)

HOPLOPSYLLUS GLACIALIS GLACIALIS (Taschenberg)

(Map 1)

Pulex glacialis Taschenberg 1880, Die Flöhe, p. 76; No. 12, pl. III, figs. 17,17a. North Pole, ex "*Lepus glacialis*" (*L. arcticus*).

Hoplopsyllus glacialis (Tachenberg). Jordan 1932, Fauna Arctica 6:117. Recorded from Greenland and Baffin Island, ex *Lepus arcticus.*

Hoplopsyllus glacialis glacialis (Tachenberg). Kohls 1939, Pub. Hlth. Repts. 54(45):2019.

Hoplopsyllus glacialis is circumpolar in distribution, and has evolved into a number of recognizable subspecies. *H. g. glacialis,* described from the "North Pole", has been recorded from Greenland and Baffin Island (Jordan 1932). *H. g. profugus* (Jordan) occurs in Asia, while the hares of much of temperate North America are infested by *H. g. lynx* (Baker).

Kohls (1939), comparing specimens of *H. g. glacialis* could distinguish no differences with *H. g. lynx* other than size, *g. glacialis* being the larger. Kohls tentatively regards *H. g. glacialis* as restricted, in North America, to the arctic hares (*Lepus arcticus* group) and their predators, and *H. g. lynx* to the varying hares or snowshoe rabbits (*Lepus americanus* group) and their predators, in regions to the south.

We have the following material which is believed to be referable to *Hoplopsyllus glacialis glacialis.* As the bulk of these specimens are somewhat over-cleared, and not suitable for illustration, no figures are provided.

New Canadian records:

N. W. T.: Arctic Red River, 15.IV.36, ex "bush rabbit" (*Lepus americanus macfarlani?*), 2♂, 6♀ (L.C.). 17.II.36, ex *Lynx canadensis*, 13♂, 30♀ (P.T.). 17.VI.37, ex *L. canadensis*, 8♂, 32♀ (R.C.M.P.). 8.I.36, ex "cross fox" (*Vulpes* sp.), 2♀ (R.C.M.P.). 10.I.36, ex. "cross fox", 1♂, 7♀ (P.T.). 17.VI.37, ex "fox", 19♂, 57♀ (R.W.C.)

Baffin Is.: Lake Harbour, 23.V.36, ex *Lepus arcticus* ssp., 4♂, 6♀ (H.A.McB.). 1.XII.34, ex *Lepus arcticus* ssp., 1♂, 1♀ (H.A.McB.)

Specimens examined: 58♂, 141♀.

HOPLOPSYLLUS GLACIALIS LYNX (Baker)

(Plate VI, figs. 21, 22; Map 1)

Pulex lynx Baker 1904, U. S. Nat. Mus. Proc. 27:378,383-384,437; pl. X, figs. 7-11; pl. XI, figs. 1,2. Both sexes from Moscow, Idaho, ex *Lynx canadensis.*

Hoplopsyllus lynx (Baker). Baker 1905, U. S. Nat. Mus. Proc. 29:130,144.

Hoplopsyllus glacialis lynx (Baker). Jordan 1932, Nov. Zool. 38:253. Recorded from Atlin, B. C., ex *Lepus americanus macfarlani.*

Hoplopsyllus glacialis lynx (Baker). Wagner 1936, Can. Ent. 68(9):194-195. Recorded from B. C., ex *Lynx fasciatus* and *Lepus americanus*, but without locality data.

Hoplopsyllus lynx (Baker). I. Fox 1940, Fleas of Eastern U. S. p. 15; pl. IV, figs. 11,13. Redescription.

Hoplopsyllus glacialis lynx (Baker). Kohls 1940, Nat. Inst. Hlth. Bul. 175:14; pl. II, figs. B,F,I; Map 7. Recorded from Dahl River, Yukon, ex *Lynx* sp., (and other localities, not in Canada).

These fleas are apparently true parasites of the varying hares (*Lepus americanus* group) and are widely distributed in North America. They are frequently collected in numbers from *Lynx* spp. This undoubtedly ties up directly with the predatory habits of these cats, which depend principally upon the hare population for existence. It may be, however, that the fleas are able to subsist directly on the lynx and bobcats as they are sometimes collected in such large numbers that it seems improbable that the total infestation is due merely to accumulations from the hare victims.

New Canadian records:

B. C.: Aberdeen Lake (Vernon), 17.V.31, ex *Lepus americanus columbiensis*, 1♀ (E.H.)
Alta Lake, 9.I.32, ex *Lynx f. fasciatus*, 1♀ (K.R.)
Anarchist Mt., 27.V.41, ex *Lepus a. columbiensis*, 1♂, 2♀ (I. McT.C.)
Grey Creek, 21.II.38, ex *Lynx canadensis*, 11♂, 29♀ (G.O.)
Kamloops, 20.XI.46, ex "bobcat" (*Lynx* sp.) 6♂, 6♀ (N.M.C.)
Lac du Bois, 10.VI.41, ex *Lepus americanus* ssp. 1♂ (I.McT. C.)
Phoenix, ex *Lepus americanus*, 1♂, 1♀ (S.P.Crew)
Rayleigh, 30.VIII.38, ex *Lepus americanus* ssp., 1♂ (G.P.H.)

Alta.: Cameron Lake, Waterton, 18.VI.39, ex *Lepus americanus bairdi*, 1♂ (J.H.B.)

N. B.: Scotch Lake, X.32, ex "hare", 1♀

N. W. T.: Rae, ex "bush rabbit", 2♀ (R.C.M.P.)

Specimens examined: 23♂, 42♀.

Sub-family B. PULICINAE Tiraboschi 1904

With the characters of the family, but distinguished from the Spilopsyllinae by the antennae which have an assymetrical club, showing but few if any traces of segmentation remaining on the fused side (see figs. 23, 26, etc.). Not associated with the Leporidae.

Four genera belonging to this subfamily occur in North America. All but one of these *(Juxtapulex)* are known from Canada. Two *(Ctenocephalides* and *Xenopsylla)* are not indigenous, but importations from the Old World, being parasites of domestic animals. *Pulex* is evidently holarctic, in fact nearly cosmopolitan, but its original range before being further distributed by the wanderings of man in historic times, is a matter for conjecture.

CTENOCEPHALIDES Stiles and Collins

Genotype: *Pulex canis* Curtis 1826.

Ctenocephalus Kolenati 1859 (not Hawle and Corda, 1847), Jahresber. d. Märischen Gesellsch. z. Beford d. Naturk. p. 65.

Ctenocephalides Stiles and Collins 1930, Pub. Hlth. Repts. 45:1308-1310.

Head evenly rounded anteriorly. Genal ctenidium horizontal, of heavy pointed spines. Genal lobe with apical tooth in the species recorded from Canada. Labial palpus 5-segmented. Pronotal ctenidium present.

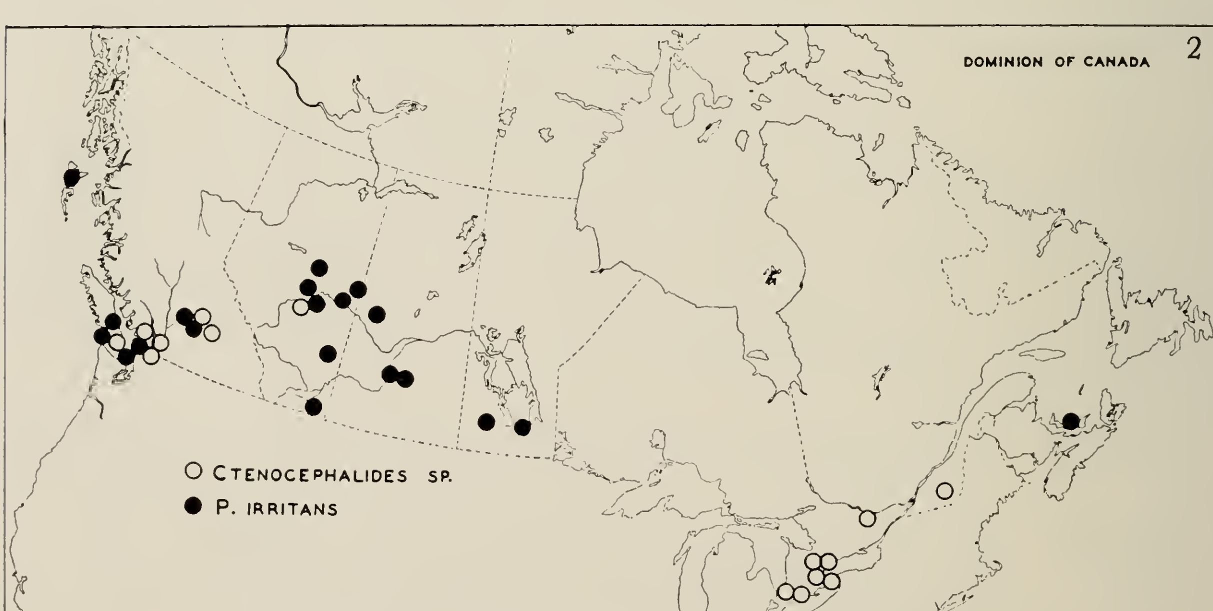
Male claspers somewhat modified. Dorsal part of clasper lobe articulated and extending posteriorly (figs. 13, 16). Below this, one moveable process.

An Old World genus, probably originally confined to Africa. Two species today are almost cosmopolitan, having followed man and his domestic pet animals over most of the World. Both are common in Canada.

Key to the species of *Ctenocephalides* found in Canada

1. Head relatively short and rounded. 1st spine of genal comb shorter than second (Pl. V, figs. 11, 12) . . . . *canis*

   Head quite long and pointed. 1st and 2nd genal spines of approximately equal length (figs. 14, 15) . . . . *felis felis*



MAP 2

Pulicidae:Pulicinae. Locality records of cat and dog-fleas, *Ctenocephalides* spp., and the "human flea", *Pulex irritans* Linnaeus.

CTENOCEPHALIDES CANIS (Curtis)

(Plate V, figs. 11, 12, 13; Map 2 (in part).)

Pulex canis Curtis 1826, Brit. Ent. 3(114); pl. CXIV, figs. A-E. From Great Britain, ex *Canis familiaris*.

Ctenocephalus canis (Curtis). Harvey 1907, Ent. Soc. B. C. Bul. 7:1. Recorded from British Columbia, ex cats and dogs.

Ctenocephalides canis (Curtis). Spencer 1936, Ent. Soc. B. C. Proc. 32:14. Recorded from black fox, dog, tame rabbit, no locality data.

Ctenocephalides canis (Curtis). Holland 1941, Ent. Soc. B. C. Proc. 37:3-4. Recorded from Vancouver and New Westminster, B. C., ex *Rattus norvegicus*.

Ctenocephalides canis (Curtis). Brown 1944, Ent. Soc. Amer. Ann. 37:208. Recorded from Edmonton, Alta, ex "*Felis catus*" (*F. domestica*) and *Canis familiaris*.

C. canis, the dog flea, and its close relative *C. felis*, the cat flea (which see) are each common parasites of cats or dogs, and in addition frequently become established in homes where, because of their painful bites, they are a great nuisance to man. In Western Canada, domestic infestations have become particularly common since the introduction of sawdust burners, the sawdust in the storage bins providing favourable conditions of humidity for the development of these fleas.

While we do not actually have a great deal of data on file, there is little doubt that both these species are well established in most centres of population across the temperate part of the Dominion. Map 2 shows the distribution of the genus *Ctenocephalides* so far as has been definitely recorded.

C. canis and *C. felis* occur not uncommonly on domestic rats *(Rattus norvegicus et al.)* along with *Nosopsyllus fasciatus* and *Xenopsylla cheopis*.

C. canis is rarely taken from any of our native mammals, but we have two records of it from the spotted skunk, *Spilogale gracilis olympica*.

C. felis felis has been taken from a raccoon, *Procyon lotor pacifica*.

Typical specimens of the two species of *Ctenocephalides* may be readily separated by the shape of the head and the character of the genal comb, as shown in the key, and the males may be further identified by the shape of the manubrium of the clasper, which in *canis* is expanded apically, (fig. 13) and not expanded in *felis* (fig. 16). There are, however, certain nontypical specimens, usually females, which are difficult to determine with certainty. Ewing and Fox (1943:109) believe that this may indicate hybridization. In view of this, the two species are treated collectively in the locality records which follow. Some of these records are extracted from the Canadian Insect Pest Review, various volumes and numbers.

Records of *Ctenocephalides* spp.

B. C.: Harrison Bay, ex *Spilogale gracilis olympica*
Kamloops, ex dog: households
Ladner, ex red fox (farm)
Vancouver, ex dogs: cats: households: *Rattus norvegicus: Spilogale gracilis olympica: Procyon lotor pacifica*
Vernon, ex households
Victoria: ex dog

Ont.: Beamsville, ex dog
Blenheim
Chatham, ex households
Georgetown, ex fox ranch
Hamilton, ex households
Ottawa, ex cat: dog: man: households
Preston, ex households
St. Catherines
Thamesville, ex cat
Toronto, ex dog

Que.: Grand Mere
Senneville
Sherbrooke, ex household (entered in carload of coal)

Specimens examined: large series, of both sexes.

CTENOCEPHALIDES FELIS FELIS (Bouché)

(Plate V, figs. 14, 15, 16, 17; Map 2 (in part).)

Pulex felis Bouché 1835. Nova Acta Physico-Medica Acad. Caes. Leop. Carol. 17:505, fig .2. From Europe, ex *Felis domestica*.

Ctenocephalides felis (Bouché). Spencer 1936, Ent. Soc. B. C. Proc. 32:14. Recorded from cat, Uganda monkey, no locality data, presumably Vancouver, B. C.

Ctenocephalides felis (Bouché). I. Fox 1940, Fleas of Eastern U. S. 24-26; pl. VI, figs. 22, 23, 25. Redescription of the species.

Ctenocephalides felis (Bouché). Holland 1941, Ent. Soc. B. C. Proc. 37:3. Recorded from Vancouver and New Westminster, B. C., ex *Rattus norvegicus*.

Ctenocephalides felis felis (Bouché). Brown 1944. Ent. Soc. Amer. Ann. 37:208. Recorded from Edmonton, Alta, ex "*Felis catus*" (*F. domestica*).

See discussion and records under *C. canis*.

PULEX Linnaeus

Genotype: *Pulex irritans* Linnaeus 1758 (cosmopolitan)
Pulex Linnaeus 1758, Systema Naturae, 10th Ed., 1:614.
Pulex Linnaeus. Jordan and Rothschild 1908, Parasitology 1(1):5-7.

Eyes large and deeply pigmented. Labial palpus 4-segmented Genal ctenidium absent, or represented by a single inconspicuous tooth (Pl. VI, fig. 23). Pronotal ctenidium absent. Pleural ridge lacking in mesopleurum (cf. *Xenopsylla*). Male claspers with two distinct hinged processes, like a pair of pincers, and with part of the clasper lobe articulated and arched over the processes (fig. 24), recalling *Cediopsylla*.

The genus contains only one species (*P. conepati* Cunha, not known from Canada) besides the genotype.

Pulex irritans, the "human flea" is known from many parts of the world.

PULEX IRRITANS (Linnaeus)

(Plate VI, figs. 23, 24, 25; Map 2)

Pulex irritans Linnaeus 1758, Systema Naturae, 10th Ed. 1:614. "Habitat ubique in Europe, Leporibus imprimis molesta; in America".

Pulex simulans Baker 1895, Can. Ent. 27:65, 67. Synonym, fide Jordan and Rothschild, 1908.

Pulex irritans Linnaeus. Baker 1904, U. S. Nat. Mus. Proc. 27:379, 436; pl. XI, figs. 3-6. Recorded from Queen Charlotte Islands (and elsewhere, not in Canada).

Pulex irritans Linnaeus. Harvey 1907. Ent. Soc. B. C. Bul. 7:1. Recorded from British Columbia, no details.

Pulex irritans Linnaeus. Jordan and Rothschild 1908, Parasitology 1(1):7-12. Redescription of the species. Many records, including, from Alberta, *Lynx* and *Vulpes velox*.

Pulex irritans Linnaeus. Spencer 1936, Ent. Soc. B. C. Proc. 32:11-17. Records domestic infestations in Vancouver, B.C.

Pulex irritans Linnaeus. Brown 1944, Ent. Soc. Amer. Ann. 37:210. Recorded from Alberta as follows: Vega, Dewberry, Stanmore, Edmonton, Mirror Landing. Hosts: house; child; *Taxidea taxus*.

Pulex irritans Linnaeus. Cowan 1946, Can. Journ. Research, D.24:77. Recorded from "coast deer" (*Odocoileus hemionus columbianus*), no locality data.

Pulex irritans Linnaeus. Can. Insect Past Review (mimeographed)—various issues. Recorded in Canada as follows: Fanny Bay, B. C.; Lac la Grande Fourche, Que. Mentions previous records from B. C., Sask. and P. E. I.; Pas Trail, Sask.; Mirror Landing, Alta.; Parksville and Victoria, B. C.; Hedgeville, N. S.; Winnipeg, Man.

Pulex irritans, the "human flea" is of widespread distribution in North America as well as in the Old World. While it has been thought that perhaps the North American stock was the result of introduction by civilized man in historic times (as with *Ctenocephalides*, *Leptopsylla*, *Nosopsyllus*, *Xenopsylla* and possibly *Ceratophyllus gallinae*) there now seems little doubt that the species is indigenous*, and it may be (as suggested by Ewing and Fox, 1943:117) that *Pulex* originated in the New World. Linnaeus of course listed it from America, but as he only recognized two species of fleas—there may be some doubt as to the determination.

Ewing and Fox recognize Baker's *dugesii*, from Mexico as a subspecies of *P. irritans*. The nearctic and neotropical genus *Juxtapulex* is obviously derived from the same ancestral stock as *Pulex*. An eyeless *Pulex* has been discovered in Guatemala (Traub, MSS).

Pulex irritans varies considerably, but up to the present the North American form has been considered identical with that of Europe and Asia.

While termed the "human flea", and well known to become established in domestic households, this species has been recorded in nature from a surprising variety of hosts. Jellison and Kohls (1936:842-844) report it as well established in prairie dog towns *(Cynomys ludovicianus)*; from *Canis latrans;* dog; and deer *(Odocoileus)* in Oregon. They also quote Chandler (1926) who recorded this species from "*Odocoileus columbianus*" in northern California (cf. Cowan's record from B. C. coast deer, 1946:77).

We have a number of records of this insect occurring in the nests of burrowing owls *(Speotyto cunicularia)*, a surprising relationship, especially as *P.*

*Evidence that domestic fleas (presumably *P. irritans*) may have been well established in coastal B.C. in the 18th century is to be found in the diary, now in the British Columbia Archives, Victoria, written in 1792 by George Goodman Hewett, assistant surgeon on board H.M.S. Discovery (Captain George Vancouver). Hewett states that during the investigation of a certain abandoned Indian village, Vancouver's men were driven out of the place by myriads of fleas which tormented them to such an extent that they rushed out into the water up to their necks!

irritans has been collected from no mouse or other small creature that could be construed as the prey of this bird.

While distributed over the Dominion, *P. irritans* seems to be particularly well established in Vancouver Island, and besides domestic infestations, we have had reports of this insect occurring in myriads in lawns, in leaves, and on sea beaches, in the accumulated seaweed at tide line!

New Canadian records:

B. C.: Kamloops, 23.IX.36, ex household, 1♂, 1♀ (T.K.M.). 26.VII.36, ex *Speotyto cunicularia hypugaea*, 5♂, 4♀ (G.J.S.); VII.38, ex *S. c. hypugaea*, 1♂, 2♀ (G.P.H.)
New Westminster, 16.VI.30, ex household, 1♂ (W.D.)
Northlands, 28.VII.44, ex household, 1♂, 1♀ (G.P.H.)
Pemberton Meadows, VIII.45, ex man, 1♂ (J.R.)
Port Alberni, 5.IX.41, ex man, 1♂, 1♀ (G.J.S.)
Tranquille, 2.VII.34, ex *Speotyto c. hypugaea*, 1♂ (G.J.S.)
Victoria, 23.III.39, ex household, 2♂, 2♀ (T.W.B.)

Alta.: Manyberries, 2.VI.40, ex *Lepus townsendii campanius*, 2♀ (G.P.H.)

Sask.: Allan's Lake, 20.VIII.40, ex man, 1♂ (L.G.S.)
Beacon Hill, XII.31, ex household, 4♂
Cochin, VI.35, ex "campers", 2♀ (F.B.)
Saskatoon, 10.III.44, ex man, 1♀ (K.M.K.). 15.VIII.35, ex man, 2♀ (K.M.K.)

Man.: Brandon, 12.XII.36, ex *Canis latrans*, 3♂, 8♀ (R.D.B.)
Harperville, 16.VII.43, ex household, 2♂, 6♀ (A.V.M.)

Que.: Temiscouata Co., 25.VIII.34, ex man, 1♂, 1♀

P. E. I.: Freetown, 14.X.33, ex household, 1♀

Specimens examined: 35♂, 50♀.

XENOPSYLLA Glinkiewicz

Genotype: *Xenopsylla pachyuromyidis* Glinkiewicz 1907 (a synonym of *Pulex cheopis* Rothschild 1903).
Xenopsylla Glinkiewicz 1907, Wien. Sitzber. Ak. Wiss. 116:381,385.
Leomopsylla Jordan and Rothschild 1908 Parisitology 1(1):15-34.
Xenopsylla Glinkiewicz. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:103-104.

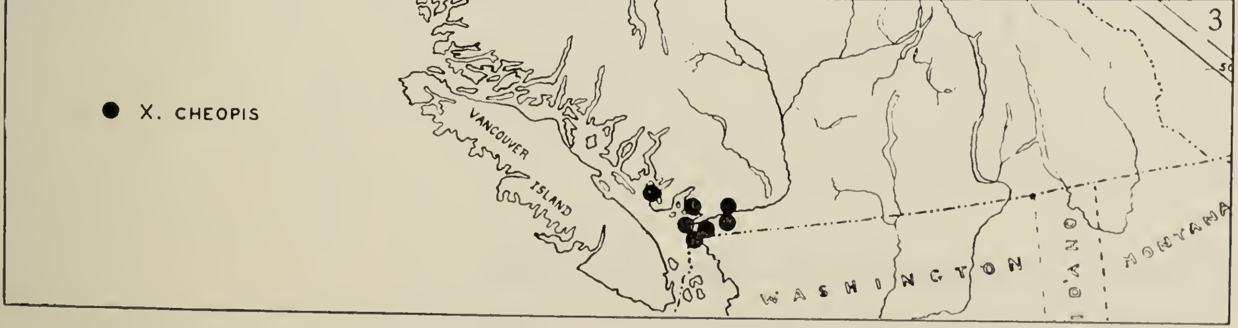
Eye well developed. Genal comb lacking. Labial palpus 4-segmented. No segmentation visible on anterior surface of clava of antenna. Pronotal ctenidium absent. Mesopleurum with conspicuous pleural ridge (fig. 26).

Claspers of male somewhat reduced and poorly sclerotized. Posterior articulated apical process of clasper simple, with setae. But one moveable process persisting.

Females with large deeply pigmented spermatheca.

An Old World genus containing many species, some of which are intimately associated with rats (*Rattus* spp.) and are of extreme economic importance in connection with the dissemination of plague.

One species is well established in a number of areas in North America, including Canada, where it has been introduced, on *Rattus*.



MAP 3
Pulicidae:Pulicinae. Locality records of the Indian rat flea, *Xenopsylla cheopis* (Rothschild).

XENOPSYLLA CHEOPIS (Rothschild)

(Plate VI, figs. 26, 27, 28; Map 3)

Pulex cheopis Rothschild 1903, Ent. Mo. Mag. 38:2nd series, 14:85-86; pl. I, figs. 3, 9; pl. II, figs. 12, 19. Described from Shendi, Egyptian Sudan, ex *Acomys, Arvicanthis, Dipodillus, Dipus, Genetta,* and *Gerbillus;* also near Suez, ex *Mus gentilis.*

Loemopsylla cheopis (Rothschild). Jordan and Rothschild 1908, Parasitology 1(1):42-45; pl. I; pl. II, fig. 8; pl. IV, fig. 8; pl. VI, fig. 1. Supplementary description, etc.

Xenopsylla cheopis (Rothschild). Holland 1940, Ent. Soc. B. C. Proc. 36:11-12. Recorded from Vancouver, B. C., ex *Rattus norvegicus* and New Westminster, B. C., ex *Rattus rattus alexandrinus.*

Xenopsylla cheopis (Rothschild). Holland 1941, Ent. Soc. B. C. Proc. 37:2-5. Plague significance discussed and counts of specimens and indices provided for Vancouver, B. C., etc.

Xenopsylla cheopis (Rothschild). Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:104-105. Status in United States discussed.

Xenopsylla cheopis (Rothschild). Holland 1944, Ent. Soc. B. C. Proc. 41:5-12. Further discussions, and records from North Vancouver and Sechelt.

Xenopsylla cheopis, the so-called "Indian rat flea" or "plague flea" is without doubt medically, the most important flea in the world. Undoubtedly a large percentage of the human cases of bubonic and pneumonic plague that have occurred during the many historical pandemics and epidemics of this disease may be attributed to the presence of this insect. Structurally, physiologically and temperamentally, it is ideally adapted to the dissemination of plague.

Actually a flea of the tropics, it does upon occasion, become established in temperate regions, and wherever it occurs, its presence is a matter of grave concern. Wu *et al.* (1936:290) remark "It may be taken as a general rule that a particular zone becomes potentially dangerous when the *cheopis* infestation reaches one flea or more per rat. This is referred to as the critical *cheopis* index of one". Accordingly, in 1939 (Holland, 1941:2-5) the rat flea samples collected by the British Columbia Plague Survey crews were examined and the numbers of the various species of fleas tabulated before testing by inoculation into guinea pigs. *X. cheopis* was found to be numerous in the Vancouver city garbage dump. Of 1403 fleas collected from 725 rats, 1021 were *cheopis;* a flea index of 1.94 and a *cheopis* index of 1.41. As most of these rats were trapped, and cold when picked up, it was felt that these figures might be below the true index. Sample lots of 30 and 26 rats were shot and bagged immediately, to prevent loss of fleas. These gave *cheopis* indices of 2.17 and 3.42 respectively.

Subsequent surveys in the British Columbia coastal region have indicated a decline in the *cheopis* population, although it is still common, especially in the garbage dumps. This localization of these fleas may be explained by the relatively increased heat and humidity to be found in rat burrows in the vicinity of decomposing garbage.

X. cheopis has now been recorded from a number of localities in southern coastal British Columbia, and from all three of the imported domestic rats, *Rattus norvegicus* (Erxleben), *Rattus rattus rattus* (Linnaeus) and *Rattus r. alexandrinus* (Geoffroy).

New Canadian records:

B. C.: Matsqui
Oakalla prison farm
Port Moody
Stanley Park (Vancouver)
Steveston
Surrey
West Vancouver
White Rock

Specimens examined: large series, of both sexes.

Family 2. VERMIPSYLLIDAE Wagner 1899.

Genal and pronotal ctenidia lacking. Head not divided by "dorsal sulcus" above antennal fossae. Eyes large and well pigmented. Clypeal tubercle present; usually deciduous. No trabecula centralis. No tentorial arms showing

in genal or ocular region. Antennal fossae open. Clava of antenna distinctly marked, all the way around.

Mesonotum with "pseudosetae" under the collar. Metanotum lacking pseudosetae or apical spinelets. No patch of spinelets on inside of coxa III. Four pairs of lateral plantar bristles on all tarsi V.

Abdominal terga lacking apical spinelets. Terga II-VII each with two rows of setae. Antepygidial setae not differentiated in either sex.

Abdominal segment VIII in males virtually unmodified. Single moveable process to each clasper. Angle of sternum IX without attached apodemal rod.

Vestige of tergum IX visible in females. Single spermatheca. Anal stylet lacking. Abdomens of gravid females capable of considerable distension, the sclerites becoming widely separated (Pl. VII, fig. 32).

Medium sized to very large fleas. Two genera in North America, of which one is recorded in Canada.

ARCTOPSYLLA Wagner

Genotype: *Pulex tuberculaticeps* Bezzi 1880 (palaearctic).
Arctopsylla Wagner 1930, Katal. d. Palaearktisch. Aphanipt.:40.
Arctopsylla Wagner. Jordan 1932, Nov. Zool. 38:291.
Arctopsylla Wagner. Wagner 1933, Konowia 12:89-90, 94.
Arctopsylla Wagner. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:18.

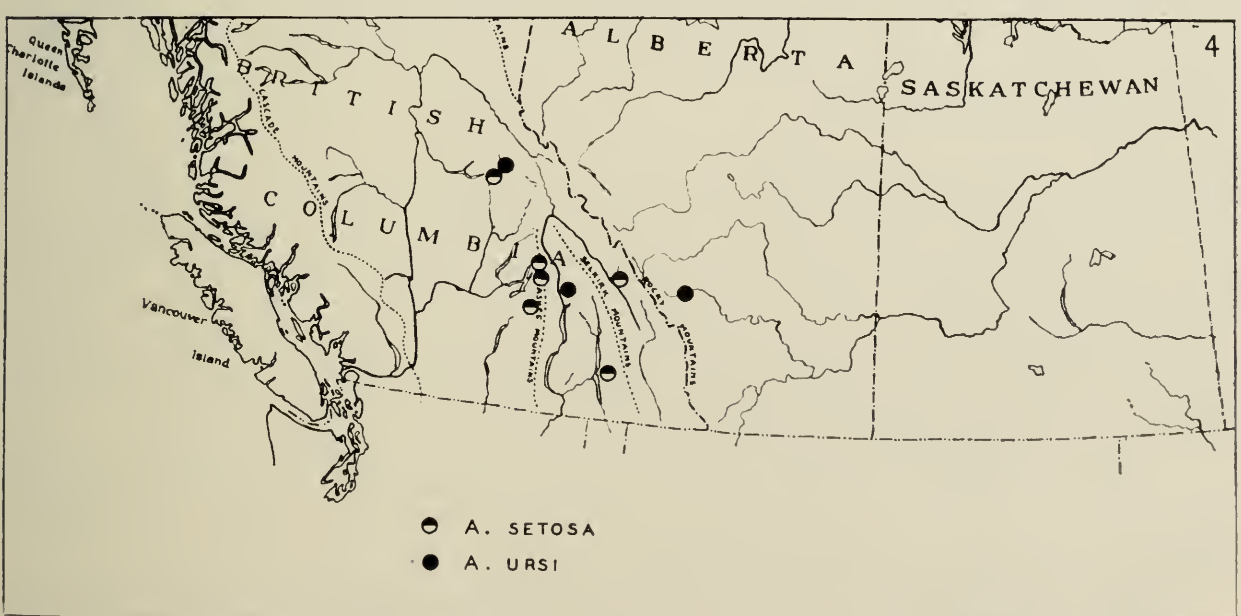
General description as for the family. Labial palpus long and of seven to ten segments. (*Chaetopsylla* is separated by possessing less than seven segments in his structure).

The genus is circumpolar, and its species infest various genera of carnivorous animals in the Old World and the New. Two nearctic species are known, both of which occur in Western Canada.

Key to the nearctic species of *Arctopsylla*

1. ♂. F very small, and inserted near the apex of the clasper (Pl. VII, fig. 30)
   ♀. Head of spermatheca longer than broad (fig. 31) .... *ursi*

   ♂. F longer, and inserted near the middle of posterior margin of clasper (fig. 33)
   ♀. Head of spermatheca usually slightly broader than long (fig. 34) .... *setosa*



MAP 4
Vermipsyllidae. Locality records of the carnivore-fleas *Arctopsylla setosa* (Rothschild) and *A. ursi* (Rothschild).

ARCTOPSYLLA SETOSA (Rothschild)
(Plate VII, figs. 33, 34; Map 4)

Chaetopsylla setosus Rothschild 1906, Can. Ent. 38:321-322; text-figs. 41, 42. One female from Eagle River, Sicamous, British Columbia, ex *Canis latrans*, and one female from Mabel Lake, B. C. ex "*Ursus americanus*" (*Euarctos a.*).

Trichopsylla (*Chaetopsylla*) *setosus* Rothschild. Spencer 1936, Proc. Ent. Soc. B. C. 32:14. Listed from "grizzly bear" (*Ursus* sp.) from British Columbia, specific locality not given.

Chaetopsylla sp. (*Ch. setosus* Rothschild ?). Wagner 1936, Zeitsch. f. Parasitenk. 8:335-336; text-figs. 2-4. Description of male from a single specimen collected ex "*Ursus horribilis bairdi*". (According to Anderson, 1946:191, this race of bear is not definitely known in Canada) locality not given. (Author's note: locality actually was Malaqua, B. C., the specimen studied by Wagner now being in the collection of the University of British Columbia.)

Arctopsylla setosa (Rothschild). Jellison and Good 1942, Nat. Int. Hlth. Bul. 178:23. Wagner's description of male accepted. Species assigned to *Arctopsylla*.

Arctopsylla setosa habitually infests the larger carnivores, especially bears, coyotes, lynx and sometimes cougars and wolverines. This flea is seldom collected, but when found at all, usually occurs in fair numbers. It appears to be confined to north western North America, only having been reported from B. C. and Montana.

New Canadian records:

B.C.: Azure Lake, 10.XI.39, ex *Ursus* sp., 1♂, 1♀ (H.M.)
Grey Creek, III.40, ex *Lynx canadensis*, 1♀ (G.O.)
Parson, winter 1943-44, ex *Gulo luscus* ssp., 3♂, 24♀ (C.H.)

Specimens examined: 5♂, 26♀.

ARCTOPSYLLA URSI (Rothschild)
(Plate VII, figs. 29, 30, 31, 32; Map 4)

Pulex ursi Rothschild 1902. Ent. Record 14(3):62-63; pl. 2. Both sexes, from 45 miles west of Calgary, Alberta, ex *Ursus horribilis*.

Arctopsylla ursi (Rothschild). Wagner 1936, Can. Ent. 68(9):195. "doubtless to be met with in British Columbia".

Trichopsylla (=*Arctopsylla*) *ursi* (Rothschild). Holland 1941, Proc. Ent. Soc. B. C. 37:10-11. Recorded from Wigwam, B. C., ex "*Ursus horribilis*" (*Ursus* sp.) and Azure Lake, B. C., ex "*Ursus horribilis*", (*Ursus* sp.).

Arctopsylla ursi (Rothschild.) Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:18-19; fig. 4,D.

Arctopsylla ursi is a larger species than *A. setosa* (some females up to 8.5 mm.), and like it, seems to be confined to northwestern North America. Jellison and Kohls (1939:2021) list it from Funny River and Anchorage, Alaska, ex "*Ursus americanus*" *(Euarctos a.)*. Bears, especially grizzlies appear to be the true hosts.

In British Columbia it is the experience of hunters and collectors that bear fleas are rare. Most animals seem to be entirely free of them, but occasionally one is shot that is heavily infested. It is probable that these fleas are most profuse in the early spring, when the hosts have just come out from hibernation.

The abdomens of gravid females of *A. ursi* swell until the terga and sterna are widely separated by the greatly expanded pleural integument (fig. 32).

We have no new records.

Specimens examined: 10♂, 40♀.

Family 3. HYSTRICHOPSYLLIDAE (Tiraboschi 1904) Baker 1905.

Eyes absent, or more or less vestigial; never large and heavily pigmented. Antennal fossae open. Segments of clava distinct all the way around. Ctenidia usually present on head and pronotum, but one or both lacking in a few genera.

Mesonotum with pseudosetae under the apical margin or collar. Metanotum without apical spinelets, but pseudosetae similar to those of mesonotum present in *Corypsylloides* and *Nearctopsylla brooksi*.

Anterior abdominal terga with apical spinelets. Antepygidial setae present except in the males of one subfamily. Pygidium usually convex (lateral aspect) and with the hair-like spicules between the pits slender or only very slightly expanded at base (cf. Ceratophyllidae).

Males with tergum VIII virtually unmodified, or slightly reduced. Sternum VIII variously expanded posteroventrally, in some cases partially enclosing the external genital apparatus. Claspers with but single moveable process. No typical acetabular setae. Posterior arm of sternum IX usually simple, rarely

bifurcate, and never with articulated lobes. Apodemal rod not attached to angle of sternum IX.

Females with anal stylet. Single spermatheca except in three genera in which the organ is paired.

A large family, the members of which infest the Insectovora and Rodentia (Simplicidentata).

There has been considerable controversy among various authors over the scope and subdivision of the Hystrichopsyllidae. As considered here, it is represented in North America, including Canada, by six subfamilies.

Subfamily A. HYSTRICHOPSYLLINAE Tiraboschi 1904

Genal ctenidium present or absent. Pronotum with ctenidium. Stigma of tergum VIII with long channel extending forward and down. Paired spermathecae except in one genus *(Stenoponia)* which normally has but one, but a case has been recorded (Ewing and Fox 1943:84) of a specimen of *S. americana* (Baker) with two*.

Extensive vestigial ctenidia (apical spinelets) on anterior abdominal terga. One genus with major ctenidum on tergum I.

Medium sized to huge fleas, associated with Insectivora and small Rodentia. Four genera in North America, all occurring in Canada.

SAPHIOPSYLLA Jordan

Genotype: *S. nupera* Jordan 1931 (palaearctic).
Saphiopsylla Jordan 1931, Nov. Zool. 36:227.

Preantennal region with three rows of setae; postantennal region with four. No genal ctenidium. Eye small. Clypeal tubercle prominent, well up from oral margin (cf. next genus). Labial palpus reaching fore trochanter, and of five segments.

Abdominal terga I-VI with short, pigmented apical spinelets, extending nearly to the spiracles. Male with posterior arm of sternum IX a simple rod with a few small apical setae.

Females with two spermathecae, and a large pod-like bursa copulatrix.

Two species known, one, the genotype, from southern France, with a subspecies described from the Dolomites, and the other (heretofore assigned to *Atyphloceras)* from eastern North America.

MAP 5
Hystrichopsyllidae: Hystrichopsyllinae. Locality records of *Saphiopsylla bishopi* (Jordan), *Atyphloceras artius* Jordan, *A. multidentatus* (C. Fox), *Hystrichopsylla tahavuana* Jordan and *Stenoponia americana* (Baker).

* Rarely, certain fleas of the family Ceratophyllidae, all of which normally possess but one spermatheca, and have only a vestigial duct to represent the other, will revert, and an individual may be produced bearing double spermathecae. The writer (Holland, 1943:175-6) recorded such a case in *Opisocrostis bruneri* (Baker) and has since seen it in *Opisocrostis t. tuberculatus* (Baker) and *Monopsyllus vison* (Baker). In all these instances, the second organ was smaller than the first.

SAPHIOPSYLLA BISHOPI (Jordan)

(Plate VIII, figs. 35, 36, 37; Map 5)

Atyphloceras bishopi Jordan 1933, Nov. Zool. 39:63; text-figs. 11, 12. Both sexes from Fairport, New York, ex *Blarina brevicauda* (type host) and *Microtus p. pennsylvanicus*.

Atyphloceras bishopi Jordan. Baker 1946, Journ. Expt. Med. 84(1):47. Recorded from Grosse Isle, Que., ex *Microtus p. pennsylvanicus* and *Peromyscus m. gracilis*.

While *Blarina* has been designated as the type host, the records of *S. nupera* from Europe, and the host-relationships of the various species of the closely allied *Atyphloceras* would suggest that the genus is more closely associated with the Microtinae.

S. bishopi appears to be a comparatively rare species.

New Canadian records:

Ont.: Smoky Falls, Kapuscasing, 31.X.37, ex *Microtus* sp., 1 ♂ (R.V.W.). 11.X.37, ex *Microtus p. pennsylvanicus*, 1 ♀ (R.V.W.)

Port Abino, Welland Co., 20.IX.46, ex *Blarina brevicauda talpoides*, 1 ♀ (E.W.J.)

Specimens examined: 1 ♂, 2 ♀.

ATYPHLOCERAS Jordan and Rothschild

Genotype: *Ceratophyllus multidentatus* C. Fox 1909.

Atyphloceras Jordan and Rothschild 1915, Ectoparasites 1:59.

Atyphloceras Jordan and Rothschild. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:38.

Close to *Saphiopsylla* from which it may be distinguished by the location of the clypeal tubercle, which is close to the anteoral corner (fig. 38). Eye somewhat larger and more heavily pigmented than in the preceding genus. The labial palpus consists of more than five segments. The ventral arm of sternum IX (♂) is expanded into a more or less triangular lobe.

A nearctic genus, apparently restricted to western North America, where six species are recognized. Two of these are known to occur in Canada. The status of one is in some doubt. True hosts are various native mice.

ATYPHLOCERAS ARTIUS Jordan

(Plate VIII, fig. 41; Map 5)

Atyphloceras artius Jordan 1933, Nov. Zool. 39:69; text-fig. 19. Single female, from Kelowna, B. C., ex "*Peromyscus* (*P. maniculatus artemisiae*).

This flea appears to be extremely rare. The only published record of its occurrence since the original description is by Augustson (1943:83) who collected females he ascribes to this species from Los Angeles county and Santa Barbara county, California, ex *Peromyscus californicus insignis*, *P. eremicus fraterculus* and *Microtus c. californicus*.

The present writer has collected extensively at and near the type locality in the hope of securing further specimens, and especially the unknown male, but without success. Recently a single male which may be of this species has come to hand. This was collected on the west side of Okanagan Lake at Ewing's Landing, about twenty miles from Kelowna. The specimen is very close, if not identical, to *A. multidentatus* Fox, but final decision must await further series of both sexes. Major Robert Traub writes that he has a pair from California (?) in which the female has a shallow sinus in sternum VII like *artius*, but the male is typical *multidentatus*. It may be that *artius* is a synonym of *multidentatus*, or, if the sternum VII character is found to be consistent throughout a certain geographical range, while the males are virtually indistinguishable, it could be allowed subspecific status.

New Canadian record:

B. C.: Ewing's Landing, 18.X.46, ex nest of *Tamiasciurus hudsonicus streatori*, 1 ♂ (W.H.)

Specimens examined: 1 ♂ (?). Figure of female after Jordan.

ATYPHLOCERAS MULTIDENTATUS (C. Fox)

(Plate VIII, figs. 38, 39, 40; Map 5.)

Ceratophyllus multidentatus C. Fox 1909. Ent. News, 20:107, 3 text-figs. Both sexes, ex *Microtus californicus* and *Neotoma*, no locality given (but probably near San Francisco, Cal.).

Ceratophyllus multidentatus Fox. C. Fox 1914, Hyg. Lab. Bul. 97:24-25; pl. IX, fig. 6; pl. XIX, fig. 51.

Atyphloceras multidentatus Fox. Jordan and Rothschild 1915, Ectoparasites 1:59.

A number of specimens that seem referable to this species are at hand. The shape of the bursa copulatrix in our females does not quite agree with that of the type female, but the details of the male genitalia tally closely. It is probable that there is a certain latitude of variation in the shape of the bursa. Our specimens also compare fairly well with two pairs of *A. multidentatus* from Alameda county, California, received from Mr. P. Quentin Tomich.

The species is now recorded for the first time in Canada, where it appears to be restricted to the southern Pacific coast and lower Fraser Valley (unless *A. artius* is the same).

New Canadian records:

B. C.: Chilliwack, 27.IV.40, ex *Rattus norvegicus*, 1♂ (J.D.G.)
Harrison Bay, 8.IV.41, ex *Peromyscus maniculatus* ssp. 1♀ (J.D.G.)
Huntingdon, III.41, ex *Microtus oregoni serpens*, 1♀ (I.McT. C.)
Vancouver, 1.XI.40, ex *Spilogale gracilis olympica*, 3♀ (I.McT.C.). 29.I.44, ex *Peromyscus m. austerus*, 1♂, 1♀ (H.D.F.). 29.I.44, ex *Microtus oregoni serpens*, 1♂ (H.D.F.). 20.I.45, ex *Peromyscus m. austerus*, 1♀ (H.D.F.)

Specimens examined: 7♂, 12♀ including the types (U. S. N. M.)

HYSTRICHOPSYLLA Taschenberg

Genotype: *Pulex talpae* Curtis 1826. (palaearctic)

Hystrichopsylla Taschenberg 1880, Die Flohe, p. 83.

Hystrichopsylla Taschenberg. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:88.

Large to very large fleas. Genal ctenidium of five or more slender spines. Eye vestigial. Trabecula centralis and anterior tentorial arms visible in head capsule. Labial palpus of five segments. Five pairs of lateral plantar bristles on all tarsi V.

In the genotype, *H. talpae*, abdominal terga II, III and IV bear fairly well developed ctenidia. These are reduced to apical spinelets in the New World species.

Males with abdominal sternum VIII produced posteroventrally. Ventral arm of sternum IX variously armed with pigmented spines.

Females with two equal spermathecae.

A holarctic genus in which five species and "subspecies" have been described from North America. Two of these may prove to be synonyms.

Study of a fair series of these large fleas from Canada has led the writer to believe that five recognizable forms (in addition to the problematical "*Pulex gigas*") are represented. Two of these, from western British Columbia, are described as new.

Jordan (1937:270) suggested that probably all Nearctic *Hystrichopsylla* should be considered as forms of *H. gigas* Kirby. However, the present writer feels that the differences between the known members of the genus are of sufficient magnitude that all should be regarded as full species until proved otherwise.

With the exception of *Hystrichopsylla gigas*, which is not included (see discussion, p. 74), typical examples of the other Canadian species may be separated by the following key. Females, unassociated with males are sometimes difficult to determine.

Key to the Canadian species of *Hystrichopsylla*

1. Occurring normally on *Aplodontia* or its predators. Known only from the lower Fraser Valley of B.C. Very large (♂'s 5 mm. ♀'s 8 mm). Four antepygidial setae in both sexes . . . . *schefferi*

Occurring on various small insectivores and rodents or their predators across the Dominion. Smaller. Three antepygidial setae 2

2. Eastern Canada only. Genal ctenidium of five spines. Male with lobe and about 5 spines or pairs of spines on apex of ventral arm of sternum IX (fig. 45) . . . . *tahavuana*

Western Canada. Genal ctenidium of more than five spines. Male without lobe on sternum IX and with more than 5 pairs of spines 3

3. Genal spines typically 6. Males with F distinctly longer than P. Sternum IX typically with 6 or 7 spines or pairs of spines 4

Genal spines typically 8. Male with F barely exceeding P. Sternum IX with 9 or 10 short spines or pairs of spines (fig. 48) . . . . *occidentalis* n. sp.

4. From Saskatchewan westward to central British Columbia. Males with longest spines of sternum IX as long as width of sternum IX near posterior apex. Sternum VIII with many setae, but without pigmented spines (fig 43) . . . . *dippiei*

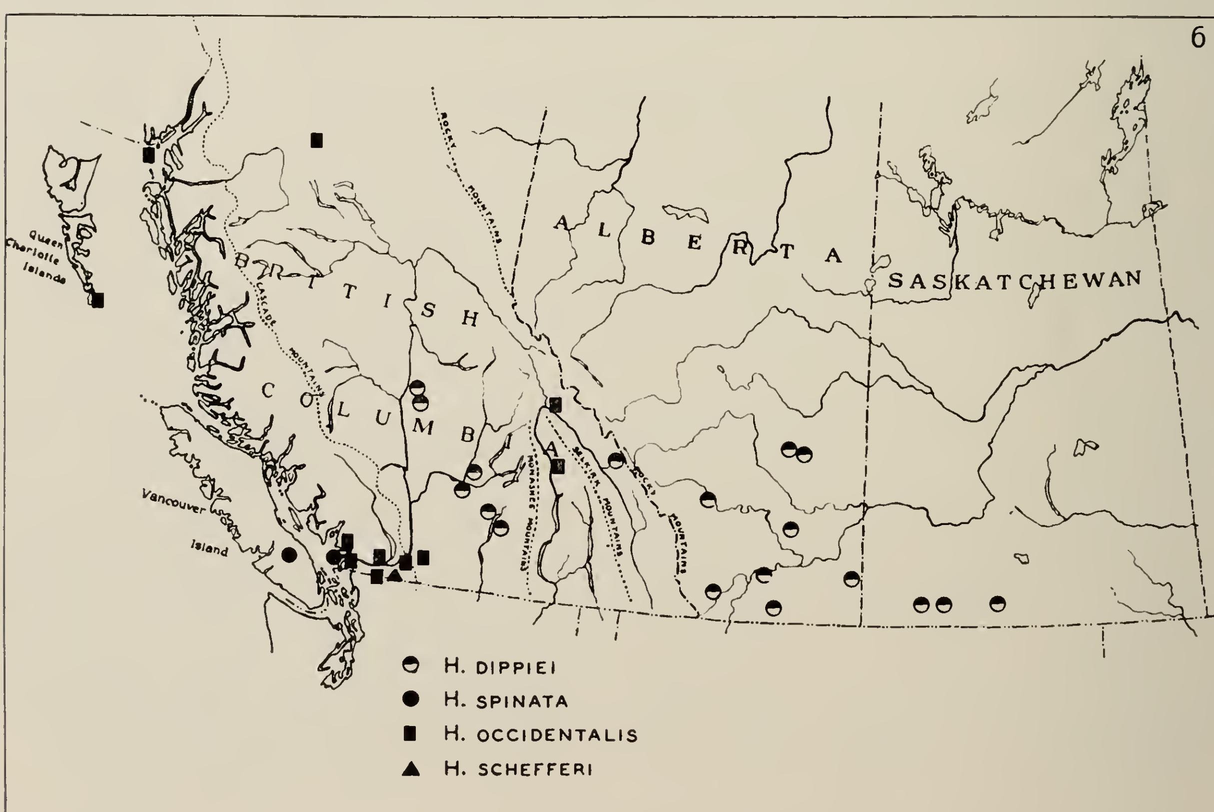
Known only from Vancouver, B.C. Longest spines of sternum IX not equalling width of sclerite at tip. Sternum VIII with a number of heavily pigmented spine-like setae at apex (figs. 50, 51) . . . . *spinata* n. sp.

HYSTRICHOPSYLLA GIGAS (Kirby)

Pulex gigas Kirby 1837. *In* Richardson's Fauna Boreali-Amer. 4:318, No. 447; pl. 6, fig. 9. "Two specimens taken in Lat. 65°". (Author's note: This locality would be at Fort Franklin on Keith Arm of Great Bear Lake, along the Great Bear River, or on the Mackenzie River somewhere in the vicinity of Norman Wells, N.W.T.).

Hystrichopsylla gigas Kirby. Jordan 1929, Nov. Zool. 35:173-174.

"*Pulex gigas*" was inadequately described and illustrated, so that the exact identity of the species has remained doubtful for years. Baker (1895:163) referred a flea now recognized as *Tamiophila grandis* (Rothschild) to this species, and the error was repeated by others. Jordan (1929) suggested that as Kirby's illustration showed a well developed genal ctenidium, the species was more likely an *Hystrichopsylla* and was in all probability synonymous with *H. dippiei* Rothschild. However, until further specimens are collected from northern Canada, he suggested that *dippiei* be considered as a subspecies of *gigas*. There is no additional evidence on this matter at the present time.



MAP 6

Hystrichopsyllidae:Hystrichopsyllinae. Locality records of *Hystrichopsylla dippiei* Rothschild, *H. occidentalis* n. sp. and *H. spinata* n. sp.

HYSTRICHOPSYLLA DIPPIEI Rothschild
(Plate IX, figs. 42, 43, 44; Map 6)

Hystrichopsylla dippiei Rothschild 1902, Ent. Rec. and Jour. Var. 14(3):63; pl. II, fig. 2. Male from Alberta, Canada, ex "*Putorius longicaudatus*" (*Mustela frenata longicauda*) and female from Chilliwack, B. C., ex "*Lutreola energamos*" (*Mustela vison energumenos*).

Hystrichopsylla dippiei Rothschild. Jordan and Rothschild 1914, Nov. Zool. 21:260. Recorded from Vancouver, B.C., ex *Peromyscus austerus* (*P. maniculatus a.*).

Hystrichopsylla dippiei Rothschild. Jordan 1929, Nov. Zool. 35:174.

Hystrichopsylla dippiei Rothschild. Wagner 1936, Can. Ent. 68(9):205. Recorded "from different localities" (in B. C.), ex *Sorex* sp. "*Spilogale phenax*" (*S. gracilis olympica*) and *Eutamias amoenus affinis*.(Author's note. Some of the material ascribed by Wagner to *dippiei* is referred to other species described elsewhere in the present paper).

Hystrichopsylla gigas dippiei Rothschild. Brown 1944, Ent. Soc. Amer. Annals 37(2):209. Recorded from Stanmore Alta, ex *Lepus* sp. and "*Thomomys fuscus*" (*Thomomys talpoides* ssp.).

While Alberta and Chilliwack, British Columbia have been named as cotype localities for *H. dippiei*, the present study would indicate the likelihood that the fleas of this group from these widely separated regions are specifically distinct. If the male from Alberta (illustrated by Rothschild) is taken to represent true *dippiei*, then our present series apparently includes no material of this species from localities west of Kamloops, B.C., all specimens of *Hystrichopsylla* which we have from the Pacific coast area being referable to *schefferi*, or to two other species, described here as new. It is possible, then, that the female from Chilliwack belongs to one of these. Furthermore, the limited material from central British Columbia shows, in the males, a slight difference in the shape of the apex of sternum IX which distinguishes it from specimens taken east of the Rockies. Adequate population samples may demonstrate this to be a good subspecific character. A few diagnostic notes on *dippiei* follow.

Genal ctenidium almost always of six spines, but a very few noted with either five or seven on one side or the other, never more. Pronotal ctenidium in males averaging 34 spines (30-37); females, 36 spines (34-39). Apical spinelets of terga II-IV variable, but approximately the same in the two sexes. Tergum II usually has 7 or 8 spinelets per side, but varies from 6 to 12; Tergum III, 6 spinelets (3-10); Tergum IV, 4 spinelets (1-6). Tergum V rarely has apical spinelets, but two individuals were found that had one per side. Three antepygidial setae in both sexes.

Males with moveable process F long, and extending for a fifth or more of its length beyond the apex of the immoveable process P. Sternum IX with a row of heavy black spine-like setae on its ventral apical margin. These spines may be single or arranged in pairs in about six groups. If more than six groups (rare) some of the middle spines are somewhat reduced in length. Total spines average about 12 (10-13), and the longest are about equal in length to the width of sternum IX at its posterior apex. Alberta and Saskatchewan specimens all have sternum IX cut off at a blunt angle apically (fig. 43), whereas the British Columbia specimens have this structure nearly square at the tip. Posterior arm of sternum VIII expanded into a lobe on either side, each with many small lateral setae, directed ventrad or cephalad, and a ventral and apical fringe of long slender setae.

A large flea, about equal to or very slightly larger than *H. tahavuana* to the east, but considerably larger than *H. occidentalis* to the west. Males (cleared and mounted specimens) averaging 4.2 mm. (3.6-5.2); females 4.9 mm. (4-6.1).

New Canadian records:

B.C.: Dempsey Lake, 10.VIII.34, ex *Tamiasciurus hudsonicus* ssp., 1 ♀ (D.C.)
Field, 11.VIII.44, ex *Clethrionomys g. saturatus*, 1 ♀ (J.H.). 13.VIII.44, ex *Microtus longicaudus mordax*, 1 ♂ (J.H.)
Kamloops, 8.VIII.37, ex *Peromyscus m. artemisiae*, 1 ♀ (G.J.S.). 14.III.41, ex nest of *P. m. artemisiae*, 3 ♀ (G.P.H.)
Kelowna, 8.IV.40, ex *Citellus c. columbianus*, 1 ♂ (G.P.H.). 11.V.44, ex *Peromyscus m. artemisiae*, 1 ♂ (G.P.H.)
Rayleigh, 17.IX.35, ex *Tamiasciurus h. streatori*, 2 ♂ (T.K.M.)
Terrace Mt., 18.X.46, ex *Clethrionomys gapperi* ssp., 1 ♂ (J.D.G.)
Williams Lake, 14.IV.44, ex *Peromyscus maniculatus* ssp., 1 ♂ (G.P.H.)

Alta.: Brooks, 30.VII.45, ex *Citellus r. richardsonii*, 1 ♀ (S.P. Crew)
Calgary, 29.VI.40, ex *C. r. richardsonii*, 1 ♀ (G.P.H.)
Cereal, 23.VI.45, ex *C. r. richardsonii*, 1 ♀ (S.P.Crew)
Elkwater, 18.VII.38, ex *C. r. richardsonii*, 1 ♀ (G.P.H.) 7.VI.40, ex *Zapus princeps minor*, 1 ♀ (G.P.H.).
Hanna, 1.VI.39, ex *C. r. richardsonii*, 2 ♀ (S.P.Crew)
Lethbridge, no host given, 1 ♂, 1 ♀ (A.E.C.)
Milk River, 9.VII.38, ex *C. r. richardsonii*, 2 ♂, 1 ♀ (G.P.H.)
Twin Butte, 30.VII.40, ex *C. r. richardsonii*, 1 ♂, 1 ♀ (S.P.Crew)

Sask.: Climax, 23.IX.42, ex *C. r. richardsonii*, 1 ♂ (S.P.Crew)
Masefield, 2.IX.44, ex *C. r. richardsonii*, 1 ♀ (J.C.)
Rock Glen, 2.IX.44, ex *Peromyscus m. osgoodi*, 1 ♂, 1 ♀ (W.F.). 30.VIII.44, ex *C. r. richardsonii*, 1 ♂ (W.F.)

Specimens examined: 20 ♂, 20 ♀.

HYSTRICHOPSYLLA TAHAVUANA Jordan

(Plate IX, figs. 45, 46; Map 5.)

Hystrichopsylla gigas tahavuana Jordan 1929, Nov. Zool. 35:173-174; fig. 8. Described from Adirondack Mts., New York, ex *Blarina brevicauda* and *Microtus pennsylvanicus*.

Hystrichopsylla gigas tahavuana Jordan. I. Fox 1940, Fleas of Eastern U. S. pp. 78-79; pl. XXI, figs. 106-108.

Hystrichopsyllus (sic!) *gigas tahavuana* Jordan. Jameson 1943, Journ. Mammal. 24(2):195. Recorded from Welland Co., Ont., ex *Blarina brevicauda talpoides*.

On the average, slightly smaller than *dippiei*, and readily separated by the five genal spines, a character which seems to be constant. Also, fewer spines on the ventral arm of sternum IX, which is, in addition, produced into a dorsal apical lobe of unique and characteristic shape (fig. 45).

True hosts appear to be insectivores. *H. tahavuana* is apparently confined to eastern North America.

New Canadian records:

Ont.: Brule Lake, Algonquin Park, June-Aug. 1934, ex *Parascalops breweri*, 3 ♂, 2 ♀ (C.H.D.C.)
Mt. Brydges, 13.VII.30, ex *Parascalops breweri*, 1 ♂ (E.D.)
Port Abino, Welland Co., 20.VIII.45, ex *Pitymys pinetorum scalapsoides*, 1 ♀ (E.W.J.)

Specimens examined: 3 ♂, 4 ♀.

HYSTRICHOPSYLLA OCCIDENTALIS new species

(Plate X, figs. 47, 48, 49; Map 6)

We have a series of a small *Hystrichopsylla* from western British Columbia which shows sufficiently constant differences, in both sexes, to distinguish it readily from other members of the genus.

General chaetotaxy much as in *H. dippiei*, but genal ctenidium nearly always of eight (rarely 7-9) fully developed spines per side. (In the very rare instances where we have specimens of *dippiei* with more than six spines, the additional one is always reduced). Pronotal comb averaging 33 spines (32-35) in males, 35 (32-39) in females. Apical spinelets of abdomen of both sexes as follows:

tergum II, average number per side, 8 (6-11). tergum III, 4.4. (3-6). tergum IV, 2.8. (1-4),— somewhat fewer than in *dippiei*.

Three antepygidial setae in both sexes.

Male. Chiefly distinguished from the other species of *Hystrichopsylla* by details of the genitalia. The moveable process F barely exceeds the immoveable process P (much longer in all the others). The ventral arm of sternum IX is characteristic, being square-cut apically, and having a long series of short, pigmented spines (fig. 48). These spines are not so noticeably arranged in pairs as in the other species, and are more numerous. The five males available have an average of 19 spines (17-20), which are quite irregular in size. Sternum VIII is much the same as in *dippiei*.

Female. Except for the smaller average size, and the increased number of genal spines, the females may not be reliably separated from *dippiei*.

The smallest known member of the genus, males averaging 3.4 mm. (3-4 mm.); females, 4.3 mm. (4.1-4.9 mm.).

Apparently the southern part of the range of this flea (in Canada) is restricted to the damp coastal areas of British Columbia, including some of the islands. It is unknown from the "Dry Belt". The most easterly records are from Mt. Revelstoke and Kinbasket Lake (Columbia Forest Region or "Interior Wet Belt"). As the females of *Hystrichopsylla* tend to be much alike, the more reliable diagnostic characters occurring in the males, some of the female specimens recorded here as of this species, but from points distant from the type locality, and without accompanying males, will not be allowed the status of paratypes. Preferred hosts appear to be various mice. While the eighteen collections of this flea available at the time of writing are from seven genera of mammals, the red-backed mouse, *Clethrionomys gapperi* is selected as the type host, as it is one of the most characteristic small mammals of the regions whence this flea is recorded, and on which it is known to occur.

Holotype male and allotype female from Mount Seymour (3400'), near Northlands, Burrard Inlet, B.C. (type locality), collected June 14, 1947 ex *Clethrionomys gapperi caurina* by G. P. Holland, No. 5716 in the Canadian National Collection, Ottawa.

Paratypes, 4 males and 9 females, collected as follows:

Mount Seymour, B.C., 27.VI.44, ex *Clethrionomys gapperi* 1 ♀ (G.P.H.). 14.VI.47, ex *Peromyscus maniculatus oreas*, 1 ♀ (G.P.H.). 14.VI.47, ex *Microtus longicaudus macrurus*, 1 ♀ (G.P.H.)

Harrison Bay, B.C., 8.IV.41, ex *Peromyscus maniculatus* ssp., 1 ♀ (J.D.G.)

Huntingdon, B.C., March, 1941, ex *Microtus oregoni serpens*, 1 ♀ (I.McT.C.). 14.III.43, ex *Microtus t. townsendii*, 1 ♀ (I.McT.C.). 15.VII.45, ex *Scapanus* sp., 1 ♀ (K.R.)

Silver Creek, Hope, B.C., 31.V.41, ex *Peromyscus maniculatus oreas*, 1 ♂ (J.D.G.)

Vancouver, B.C. 27.III.32, ex nest of *Sorex* sp. 1 ♀ (K.G.). 20.I.45, ex *Peromyscus maniculatus austerus*, 1 ♂ (H.D.F.); ex *Rattus norvegicus*, 1 ♂ (F.L.B.)

Driftwood River, B.C., Feb., 1938, ex *Clethrionomys gapperi saturatus*, 1 ♂ (J.F.S.F.)

Three Brothers Mt., Manning Park, B.C., 2.VIII.45, ex *Phenacomys intermedius* ssp., 1 ♀ (G.C.C.)

Five other females, almost certainly of this species, but not listed here as paratypes, are:

Mt. Revelstoke, 3000', 18.V.45, ex *Microtus longicaudus mordax*, 1 ♀ (G.P.H.)

Kinbasket Lake, B.C., 9.VIII.45, ex *Peromyscus maniculatus* ssp. 1 ♀ (G.P.H.)

Kungnit Is., Queen Charlotte Islands, B.C., 9.VIII.46, ex *Rattus rattus*, 2 ♀ (C.J.G.)

Somerville Is., B.C., 10.VI.45, ex *Peromyscus* sp., 1 ♀ (H.D.F.)

HYSTRICHOPSYLLA SPINATA new species

(Plate X, figs. 50, 51, 52; Map 6)

We have one male and four females of a large *Hystrichopsylla* collected at different times at Vancouver, British Columbia, all from the little spotted skunk, *Spilogale gracilis olympica*. While this is in territory known to be inhabited also by *H. occidentalis*, these fleas are distinguished at once by larger size, six genal spines instead of eight, and, in the males, by the peculiar structure of sternum VIII. In most respects these fleas resemble true *dippiei* from central and eastern British Columbia, and Alberta and Saskatchewan, but in view of the fact that we have no specimens of typical *dippiei* from western British Columbia, and the vestiture of st. VIII is so different from that seen in any other member of the genus, this small series is considered at present to represent a species new to science.

Genal ctenidium of six well developed spines per side. Frontal row of seven strong setae. Pronotal ctenidium of 31 spines in the single male, and usually 35 (35-36) in the females. Apical spinelets of abdomen averaging, tergum II, 7.6 (6-9); tergum III, 5.2 (4-6); tergum IV, 3.6 (3-5). Three antepygidial setae in both sexes.

Male. Genital claspers (fig. 50) with F much longer than P, and broader at midpoint than in *dippiei*. Ventral arm of sternum IX nearly square-cut at apex, and with 16 spines, of which 12 are large, and in pairs, whereas 4 are smaller. Sternum VIII quite characteristic, having a number of heavily pigmented spine-like setae at the apex. The two sides of sternum VIII in the single male available are not quite alike (see fig. 51). The right side has two large, heavy, blunt spiniforms. The left side has but one, and below this, three or four pigmented setae of lesser magnitude. There is a ventral fringe of long slender setae, and some small lateral hairs.

Female. Somewhat larger than average *dippiei*, and with larger spermathecae. Average length and width of head of spermatheca 36.5 x 23.5 units (limits of length, 40-34. width, 24-20.5). *H. dippiei*, by same scale of measurements (eleven examples), average length and width, 30.7 x 20.6 (limits: length, 34-29; width, 21-20).

A large flea, the male measuring 5 mm. Females averaging 5.35 (5-6.1 mm.).

Holotype male and allotype female collected October 16, 1936, on the University of British Columbia campus (type locality), Vancouver, B.C., ex *Spilogale gracilis olympica*, by G. P. Holland, No. 5717 in the Canadian National Collection, Ottawa.

Three female paratypes, all from Vancouver, and the same host, collected: 22.X.36, 1 ♀ (G.P.H.). 24.X.36, 1 ♀ (G.P.H.); 17.II.32 (K.R.) (this last specimen badly overcleared in mounting).

Two additional females, from Cowichan Lake, Vancouver Island, ex *Martes caurina vancouverensis*, 22.II.41, and *Mustela erminea anguinae*, 16.III.41, collected by Jas. Hatter, may be of this species.

It is unlikely that *Spilogale*, *Martes* or *Mustela* are true hosts of these fleas, as all other members of the genus occur on Rodentia or Insectivora. The present records almost undoubtedly may be explained by predation.

HYSTRICOPSYLLA SCHEFFERI Chapin

(Plate X, figs. 53, 54; Map 6)

Hystrichopsylla schefferi Chapin 1919, Brookl. Ent. Soc. Bul. 14:50-52. Described from a single female collected at Puyallup, Wash., ex nest of "mountain beaver" (*Aplodontia rufa* ssp.).

Hystrichopsylla mammoth Chapin 1921, Ent. Soc. Wash. Proc. 23:25-27. Both sexes, from Mammoth, Mono Co., California, ex "*Aplodontia californica*" (*A. rufa c.*) and Yosemite Nat. Pk., probably off *Aplodontia*. (possible synonym).

Hystrichopsylla mammoth Chapin. Jordan 1937, Nov. Zool. 40:270-271; text-fig. 56.

There is doubt in the minds of some students of western fleas as to the specific distinction of *schefferi* and *mammoth*. The separating characters, involving size as well as chaetotaxy, seemed adequate in the original small series. However, members of the genus *Hystrichopsylla* are somewhat variable and it is possible that *mammoth* should be considered as a synonym of *schefferi*. A female from British Columbia was submitted to Dr. Chapin for his opinion and he replied that, oddly enough, it tallied most closely with *mammoth!* We have too few of these large mountain beaver fleas in the Kamloops collection to make definite commitments with regard to synonymy, but on the basis of geographical considerations, it seems safest to the writer to regard the present small series as *schefferi*.

Following are the first Canadian records of this interesting flea—the largest known in our fauna. It will be noted that neither record is from *Aplodontia*, but from animals apt to be its predators, or at least in close association. *Aplodontia* is known from the localities mentioned.

New Canadian records:

B.C.: Cultus Lake, 9.XI.40, ex *Mustela vison energumenos* 3♂, 1 ♀ (D.L.)
Huntingdon, 8.III.41, ex *Spilogale gracilis olympica*, 1♂ (K.R.)

Specimens examined: 4♂, 2 ♀.

STENOPONIA Jordan and Rothschild

Genotype: *Hystrichopsylla tripectinata* Tiraboschi 1902 (palaearctic)

Stenoponia Jordan and Rothschild 1911, Zool. Soc. Lond. Proc., p. 391.

Stenoponia Jordan and Rothschild. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:87; fig 9.A.

Rostrum shorter than maxillary lobe. Labial palpus 2-segmented. Genal ctenidium of ten or more long spines per side. Eyes absent.

Ctenidium of pronotum of many spines, fringing the whole length of the posterior margin of that sclerite. Thoracic nota each with four or more rows of setae. Abdominal tergum I with well developed ctenidium. Terga II-V with many apical spinelets (Pl. XI, fig. 55).

Sternum VIII of male unmodified except for slight posterior expansion.

No heavily pigmented spines on elements of male genitalia.

Females normally with but one spermatheca.

A holarctic genus, with one species recognized in North America.

STENOPONIA AMERICANA (Baker)
(Plate XI, figs. 55, 56, 57, 58; Map 5)

Histrichopsylla americana Baker 1899, Ent. News 10:37-38. Female from Orono, Maine, ex "*Evotomys*" (*Clethrionomys* sp.).
Stenoponia americana (Baker). Rothschild 1915, Ectoparasites 1:30.
Stenoponia wetmorei Chapin 1919, Brookl. Ent. Soc. Bul. 14:52-54. Synonym, fide Jellison and Good (1943:133).
Stenoponia americana (Baker). I. Fox 1940, Fleas of Eastern U. S., pp. 81-84; pl. XXV, figs. 128,130,132.
Stenoponia americana (Baker). Morris 1943, Acadian Nat. 1(1):35. Recorded from New Brunswick and the Gaspé (specific locality not cited) ex *Clethrionomys gapperi ochraceus*.

This large (4-5 mm.) and extremely bristly flea occurs chiefly in eastern North America, but has been recorded as far west as Montana (Jellison, Kohls and Mills 1943:6). Hosts are small rodents and insectivores.

New Canadian records:
Man.: Aweme, 19.X.13, no host given, 1 ♀ (N.C.)
Ont. Algoma, 23.VII.35, ex *Peromyscus m. gracilis*, 1 ♀ (C.H.D.C.)
Specimens examined: 1 ♂, 4 ♀, including the type ♀ (U. S. N. M.)

Subfamily B. NEOPSYLLINAE Oudemans 1909.

Eyes reduced. Head more or less divided by an interantennal groove. Clypeal tubercle well developed—reduced—or absent. Genal ctenidium present or absent. When present it consists of two overlapping spines directed ventrocaudad.

Coxa III with a row or patch of spiniforms on inner surface. In a few genera these are reduced to slender hairs. In the genera where the spinelets are well-developed, there is a finely striated patch on either side of the basal abdominal sternum (cf. Rhadinopsyllinae), suggesting that these structures may be used as stridulating organs (fig. 63).

Terminal segment of some tarsi with the first (basal) pair of plantar bristles shifted ventrally, Antepygidial setae present in both sexes.

No spiniforms on the upper clasper processes, although the apex of the ventral arm of sternum IX is frequently armed with heavy pigmented setae. Tergum VIII of male slightly reduced. Sternum VIII somewhat expanded and sometimes lobed.

Females with single spermatheca, the tail of which may or may not project into the lumen of the head.

Seven nearctic genera belong here. All but one *(Phalacropsylla)* have been recorded from Canada.

CATALLAGIA Rothschild

Genotype: *Typhlopsylla charlottensis* Baker 1898.
Catallagia Rothschild 1915, Ectoparasites 1:41-43.

Clypeal tubercle present. No genal ctenidium. Two rows of setae on preantennal region of head (fig. 59). Postantennal region with three rows. Labial palpus of five segments, and not reaching apex of fore coxa. Coxa III with patch of spinelets. Stigma of abdominal segment VIII enlarged. Fifth segment of fore and mid tarsi with five pairs of plantar bristles, four lateral and a proximal ventral pair. Hind tarsus with but four pairs, all lateral.

A nearctic genus, represented by nine or more species, of which three are known from Canada. These fleas are chiefly found on mice.

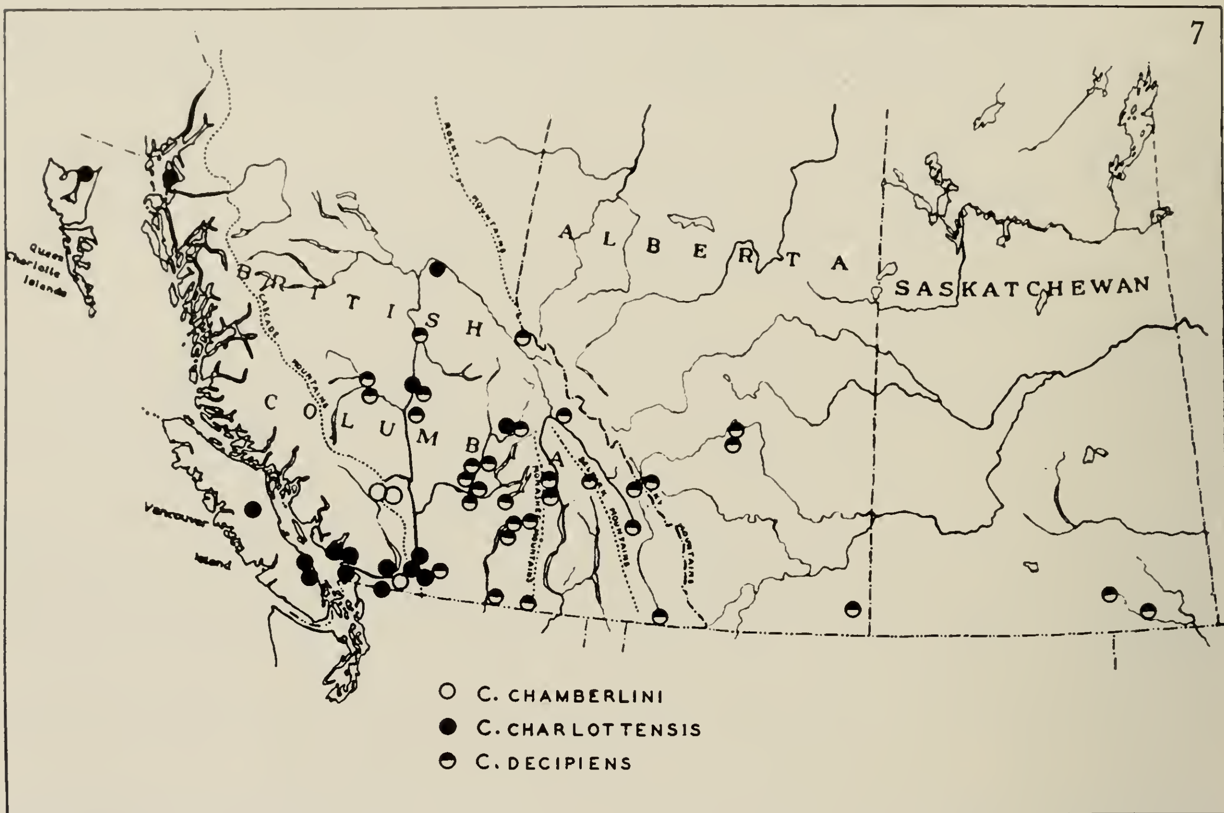
Key to the Canadian species of *Catallagia*

Males.
1. Ventral arm of sternum IX with four short subequal spiniforms. Western British Columbia only 2
Sternum IX with three unequal spiniforms (Pl. XII, fig. 66). Occurring only east of the Cascades . . . . *decipiens*

2. Only a few setae on the ventral arm of sternum IX in addition to the spiniforms (fig. 61) .... *charlottensis*

Sternum IX with a thick ventral fringe of setae, of which the anterior three or four may be somewhat thickened (fig. 64) .... *chamberlini*

Note: the females of *Catallagia* do not key well. See notes on the species, and figs. 62, 65 and 67.



MAP 7

Hystrichopsyllidae:Neopsyllinae. Locality records of *Catallagia chamberlini* Hubbard, *C. charlottensis* (Baker) and *C. decipiens* Rothschild.

CATALLAGIA CHAMBERLINI Hubbard

(Plate XII, figs. 63, 64, 65; Map 7)

Catallagia chamberlini Hubbard 1940. Pac. Univ. Bul. 37(3):4; figs. Types (both sexes) from Rocky Point (north of Klamath Falls), Oregon, ex "deer mouse" (*Peromyscus*). Range: Cascade and Siskiyou mountains of Oregon, with encroachments into the Willamette Valley.

A small series of fleas from the Cascade Mountains of British Columbia seems undoubtedly to be of this species. Three males, however, from Chilliwack and Agassiz, B.C., while tentatively being recorded as *chamberlini* do not show the thickened anterior setae in the ventral patch on sternum IX. Further collections from the lower Fraser Valley may show them to be *C. sculleni* Hubbard 1940, which they resemble somewhat. Neither species has previously been recorded from Canada. They may be synonymous.

New Canadian records:

B.C.: Agassiz, 20.I.40, ex *Scapanus orarius schefferi*, 1♂ (H.G.F.)
Birken, 13.IV.40, ex *Peromyscus maniculatus* ssp., 1♀ (G.P.H.). 15.IV.40, ex *Eutamias* sp., 1♀ (G.P.H.)
Chilliwack, 19.V.43, ex *Peromyscus maniculatus* ssp., 2♂ (J.D.G.)
Tenquille Lake, 30.VII.45, ex *Peromyscus m.* ssp., 1♂, 2♀ (G.P.H.). 30.VII.45, ex *Clethrionomys gapperi* ssp., 2♂, 2♀ (G.P.H.). 2.VIII.45, ex *Microtus richardsonii richardsonii*, 1♂ (G.P.H.)

Specimens examined: 8♂, 7♀, including a pair of paratypes (U. S. N. M.)

CATALLAGIA CHARLOTTENSIS (Baker)

(Plate XII, figs. 59, 60, 61, 62; Map 7)

Typhlopsylla charlottensis Baker 1898, Journ. N. Y. Ent. Soc. 6:56. Female, from Masset, Queen Charlotte Islands, B. C., ex "mouse nest" (probably *Peromyscus maniculatus keeni*).

Ceratophyllus charlottensis (Baker). Baker 1904, U. S. Nat. Mus. Proc. 27:386,390-391,441; pl. 12, figs. 6-10.

Catallagia charlottensis (Baker). Rothschild 1915, Ectoparasites 1:43; text-figs. 44,46. Male described from Inverness British Columbia, ex "*Peromyscus macrochirus*" (*P. maniculatus macrorhinus*).

Catallagia charlottensis (Baker). Wagner 1936, Can. Ent. 68(9):202-203. Recorded from Vavenby, B. C., ex *Citellus columbianus*.

Our collections would indicate that the species is a common parasite of mice of British Columbia, west of the Cascades. East of here it is practically replaced by *C. decipiens*, although there are on our files four definite records of *charlottensis* east of these mountains. *C. chamberlini* (which see) apparently encroaches into the southern part of its range.

New Canadian records:

B.C.: Agassiz, 7.VI.34, ex *Scapanus* sp., 1 ♀ (R.G.)
Aleza Lake, 8.VIII.43, ex *Peromyscus m. borealis*, 1 ♂ (L.C.C.)
Allison Pass, 28.VII.45, ex *Peromyscus m.* ssp., 1 ♀ (G.C.C.)
Caulfeild, 8.VII.36, ex *Peromyscus m. austerus*, 1 ♂ (J.D.G.)
Chapmans, 30.IX.42, ex *Peromyscus m.* ssp., 1 ♂, 1 ♀ (G.P.H.)
Cultus Lake, 6.VII.45, ex *Peromyscus m.* ssp., 5 ♂, 4 ♀ (G.P.H.)
Gambier Island, 3.VII.39, ex *Peromyscus m. austerus*, 1 ♂, 2 ♀ (G.P.H.)
Gleneagles, 27.III.41, ex *Peromyscus m. austerus*, 1 ♂ (J.D.G.)
Harrison Bay, 8.IV.41, ex *Peromyscus m. austerus*, 1 ♀ (G.P.H.)
Huntingdon, III.41, ex *Microtus oregoni serpens*, 2 ♂, 1 ♀ (I.McT.C.). 14.III.43, ex *Microtus t. townsendii*, 3 ♀ (I.McT.C.)
Manning Park, VIII.45, ex *Peromuscus m.* ssp., 4 ♂, 2 ♀ (G.C.C.)
Mariwood Lake. V. I., 1.IX.43, ex *Peromyscus m. interdictus*, 1 ♂, 1 ♀ (G.C.C.)
Mt. Seymour, 27.VI.44, ex *Peromyscus m. oreas*, 4 ♂, 1 ♀ (G.P.H.); 27.VI.44, *Clethrionomys gapperi*, 1 ♂, 1 ♀ (G.P.H.)
Nanaimo, V. I., 5.VIII.44, ex *Peromyscus m.* ssp., 1 ♂ (H.D.F.)
Silver Creek, 26.IV.40, ex *Peromyscus m. oreas*, 3 ♂, 6 ♀ (J.D.G.). 31.V.41, *Microtus longicaudus macrurus*, 1 ♂ (J.D.G.)
Three Brothers Mt., 15.VIII.45, ex *Microtus* sp., 1 ♂ (G.C.C.). 5.VIII.45, *Synaptomys* sp., 1 ♀ (G.C.C.)
Tulameen, 7.V.42, ex *Peromyscus m.* ssp. 1 ♂ (G.P.H.)
Vancouver, I.45, ex *Peromyscus m. austerus*, 10 ♂, 2 ♀ (H.D.F.). ex *Scapanus orarius schefferi*, 2 ♀ (G.J.S.) 14.XI.44, ex *Microtus oregoni serpens*, 1 ♀ (H.D.F.) 13.IX.35, ex *Rattus norvegicus*, 1 ♀ (F.L.B.); 16.I.45, ex *Neürotrichus g. gibbsii*, 1 ♀ (H.D.F.)
Yellow Point, V.I., XII.44, ex *Peromyscus m.* ssp. 2 ♂, 1 ♀ (A.C.B.)
Williams Lake, 7.IV.44, ex *Peromyscus m.* ssp., 1 ♂ (G.P.H.); 7.IV.44, ex nest of *Microtus* sp., 1 ♂ (G.P.H.)

Specimens examined: 43 ♂, 52 ♀.

CATALLAGIA DECIPIENS Rothschild

(Plate XII, figs. 66, 67; Map 7)

Catallagia decipiens Rothschild 1915, Ectoparasites 1:43-44, text-figs. 45, 47. Both sexes, from Horse Creek, Upper Columbia Valley, B. C., ex *Peromyscus;* male from "Blackfalls" (Blackfalds), Alta, no host given; male and female from British Columbia, ex *Neotoma cinerea;* female from Red Deer, Alberta, ex "*Evotomys saturatus*" (*Clethrionomys gapperi loringi*) =*C. charlottensis* Rothschild 1905, nec Baker 1898, err. det.

Catallagia decipiens Rothschild. Wagner 1936, Can. Ent. 68(9):203. Recorded from Vavenby, B. C., ex *Citellus columbianus* (cf. record of *C. charlottensis*, same data); and Jamieson Creek, B. C., ex *Eutamias amoenus*.

C. decipiens appears to be a widespread and common species, infesting a number of genera of mice and other rodents rather indiscriminately, although it seems to prefer *Peromyscus* and *Microtus*. It has not been taken west of the Cascades in British Columbia, but ranges eastward through Alberta and Saskat-chewan, and possibly further. It is common in mouse nests.

The male is quite easily distinguished from other members of the genus, but the female is not always so readily recognized. In general, there are more setae on sternum VII, and the head and tail of the spermatheca are broader than in *charlottensis* (cf. figs. 62 and 67). *C. chamberlini* usually has a characteristic lobe on sternum VII (fig. 65) but not always.

New Canadian records:

B.C.: Berg Lake, Mt. Robson, 26.VII.44, ex *Peromyscus m. borealis*, 1♂ (G.P.H.); 25.VII.44, ex *Microtus longicaudus mordax*, 1♂, 2♀ (G.P.H.); 26.VII.44, ex *Phenacomys intermedius*, 1♂ (G.P.H.)
Black Pines, 8.IX.29, ex *Tamiasciurus hudsonicus streatori*, 1♀
Blanket Mt., (6000'), 1.VIII.46, ex *Clethrionomys gapperi* ssp., 1♀ (G.P.H.)
Campbell Range, 3.VI.42, ex *Thomomys talpoides incensus*, 2♀ (G.P.H.)
Copper Creek, 8.V.42, ex *Peromyscus m.* ssp. 3♂, 6♀ (G.P.H.). 8.V.42, *Clethrionomys gapperi* ssp., 1♀ (G.P.H.); 8.V.42., ex *Phenacomys i. intermidius*, 1♀ (G.P.H.); 9.V.42, ex *Ochotona princeps fenisex* 1♀ (G.P.H.)
Eagle Pass, 17.V.45, ex *Peromyscus m. artemisiae* 1♂ (G.P.H.)
Glacier, VIII.42, ex *Peromyscus m.* ssp., 1♀ (J.D.G.)
Grand Forks, 13.VI.40, ex *Citellus c. columbianus*, 1♀ (S.P.Crew)
Hanceville, 27.III.41, ex *Tamiasciurus hudsonicus* ssp., 1♀ (G.P.H.)
Kamloops, 14.III.41, ex *Peromyscus m. artemisiae*, 6♂, 6♀ (G.P.H.); 12.IV.44, ex *Microtus pennsylvanicus drummondi*, 2♂, 2♀ (G.P.H.). 16.VI.45, ex *Microtus montanus canescens*, 1♂, 1♀ (G.P.H.)
Kelowna, 8.IV.40, ex *Peromyscus m. artemisiae*, 1♂, 3♀ (G.P.H.); 12.IV.40, ex *Citellus c. columbianus*, 1♀ (S.P.Crew)
Kinbasket Lake, 9.VIII.44, ex *Peromyscus m.* ssp., 1♂, 5♀ (G.P.H.); 6.VIII.43, ex *Microtus longicaudus mordax*, 1♂ (G.P.H.); 14.VIII.44, ex *Clethrionomys gapperi saturatus*, 1♂ (G.P.H.); 9.VIII.44, ex *Zapus princeps idahoensis*, 1♀ (G.P.H.)
Lac la Hache, 3.VII.42, ex *Peromyscus m. artemisiae*, 2♀ (G.C.C.)
Newgate, 7.VII.40, ex *Citellus c. columbianus*, 1♀ (S.P.Crew)
Nicola, 23.VIII.33, ex *Eutamias amoenus affinis*, 1♀ (E.H.)
Okanagan Center, 5.V.37, ex *Microtus pennsylvanicus drummondi*, 1♀ (G.P.H.)
Oliver, 24.V.45, ex *Peromyscus m. artemisiae*, 1♂, 2♀ (G.P.H.)
Paradise Mine, 25.VIII.44, ex *Microtus longicaudus mordax*, 4♀ (G.P.H.)
Paul Lake, 21.VIII.39, ex *Peromyscus m. artemisiae*, 1♂ (G.P.H.); 19.V.44, ex *Clethrionomys gapperi saturatus* ,1♂ (G.P.H.)
Quesnel, 19.VIII.43, ex *Peromyscus m. borealis*, 1♀ (M.S.)
Rayleigh, 25.IX.39, ex *Tamiasciurus h. streatori*, 1♀ (G.P.H.)
Redstone, 13.VII.44, ex *Ochotona princeps* ssp., 1♀ (L.J.)
Roosville, 19.V.40, ex *Citellus c. columbianus*, 1♂ (S.P.Crew)
Salmon Arm. 16.IV.34, ex *Tamiasciures h. streatori*, 1♂ (E.R.B.)
Sugar Lake, 16.V.42, ex *Peromyscus m. artemisiae*, 1♀ (G.P.H.)
Tulameen, 7.V.42, ex *Peromyscus m.* ssp., 3♂, 3♀ (G.P.H.)
Vavenby, 9.IV.40, ex *Peromyscus maniculatus* ssp., 6♂, 5♀ (J.D.G.); 16.IV.40, ex *Mustela frenata* ssp., 1♀ (J.D.G.); 8.IV.40, ex *Ochotona princeps* ssp., 1♀ (J.D.G.)
Williams Lake, 14.IV.44, ex *Sorex*, sp., 1♀ (G.P.H.); 14.IV.44, ex *Peromyscus m.* ssp., 4♂, 7♀ (G.P.H.); 13.IV.44, ex nest of *Microtus p. drummondi*, 2♂, 6♀ (G.P.H.)

Alta.: Banff, 14.VII.39, ex *Peromyscus m. borealis*, 3♀ (J.D.G.)
Blackfalds, 22.VI.40, ex *Peromyscus m. borealis*, 2♂, 5♀ (G.P.H.)
Elkwater, 7.VI.40, ex *Peromyscus m. osgoodi*, 1♂, 3♀ (G.P.H.)
Twin Butte, 30.VII.40, ex *Citellus r. richardsonii*, 1♂ (S.P.Crew)

Sask.: Ceylon, 4.VII.42, ex *Onychomys leucogaster missouriensis*, 1♂ (G.P.H.)
Estevan, 23.VII.42, ex *Microtus pennslyvanicus drummondi*, 1♂ (G.P.H.)

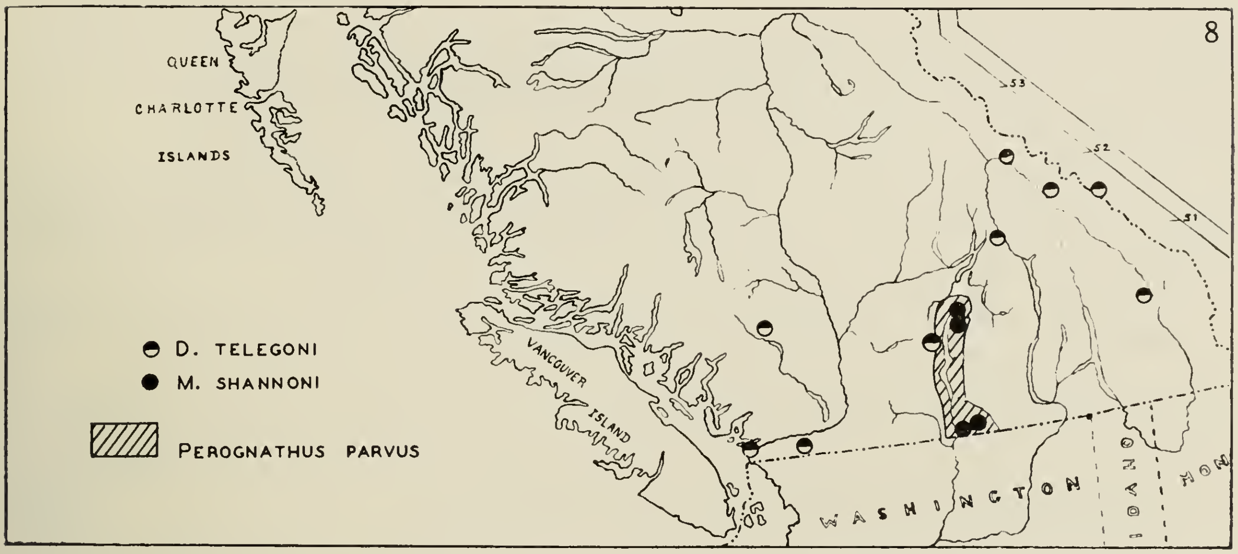
Specimens examined: 70♂, 100 (plus) ♀.

DELOTELIS Jordan

Genotype: *Ceratophyllus telegoni* Rothschild 1905.
Delotelis Jordan 1937, Nov. Zool. 40:267.

Close to *Catallagia*, but with three rows of setae on the preantennal region of the head (Pl. XII, fig. 68). Labial palpus as long as the fore coxa. No genal ctenidium. Stigma of abdominal segment VIII not enlarged. Sternum VIII in the male with heavy ventral fringe of setae. Ventral arm of sternum IX with modified pigmented sub-apical setae. The original description states "hindtarsal segment V with one ventral bristle in between the first lateral pair". In our specimens of *D. telegoni*, this character is variable, there being sometimes one bristle, sometimes two, and sometimes none—just the four lateral pairs.

Nearctic. Only one rare species known.



MAP 8
Hystrichopsyllidae:Neopsyllinae. Locality records of *Meringis shannoni* (Jordan), (superimposed on the range of pocket mice, *Perognathus parvus* ssp., modified after Osgood 1900 by I. McT. Cowan, University of British Columbia), and *Delotelis telegoni* (Rothschild).

DELOTELIS TELEGONI (Rothschild)

(Plate XII, figs. 68, 69, 70; Map 8)

Ceratophyllus telegoni Rothschild 1905, Nov. Zool. 12:172-174; pl. 9, figs. 27, 30. Both sexes from Horse Creek, Upper Columbia Valley, B. C., ex "*Microtus drummondi*" (*M. pennsylvanicus d.*); female from Kicking Horse Canyon, Alta, ex "*Evotomys gapperi*" (*Clethrionomys g. saturatus*).
Catallagia telegoni (Rothschild). Jordan and Rothschild 1915, Ectoparasites 1:42.
Delotelis telegoni (Rothschild). Jordan 1937, Nov. Zool. 40:267.

D. telegoni appears to be rare, although widespread in western North America. Augustson (1941:154) records it from Mammoth Lakes, California, ex *Peromyscus* and Hubbard (1943:9) lists it from Forest Grove, Oregon, ex *Microtus*. In Canada, it occurs from the Rockies to the Pacific, on mice of various genera and species. It may be that the rarity of this flea is more apparent than real, and that its scarcity in collections is due to a very restricted season of adult activity —or a tendency to remain confined to the nest, rather than travel on the host. The few specimens available have all been collected from late summer to early spring.

The spermatheca is large, with a bulbous turnip-shaped head (fig. 70).

New Canadian records:

B.C.: Eagle Pass (Revelstoke), 17.V.45, ex *Microtus longicaudus mordax*, 1 ♂ (G.P.H.)
Huntingdon, 14.III.43, ex *Microtus t. townsendii*, 1 ♀ (I.McT. C.)
Kinbasket Lake, 9.VIII.44, ex *Peromyscus maniculatus* ssp., 1 ♂ (G.P.H.); 6.VIII.43, ex *Microtus longicaudus mordax*, 1 ♂ (G.P.H.)
Paradise Mine, 25.VIII.44, ex *Microtus longicaudus mordax*, 1 ♂ (G.P.H.)
Tenquille Lake, VIII.45, ex *Clethrionomys gapperi*, 3 ♂, 1 ♀ (J.R.)
Terrace Mt., Vernon, 18.X.46, ex *Clethrionomys gapperi* ssp., 1 ♀ (J.D.G.)
Vancouver, 8.II.28, ex *Peromyscus m. austerus*, 1 ♂ (G.J.S.); 16.I.45, ex *Microtus oregoni serpens*, 1 ♂, 2 ♀ (H.D.F.)

Specimens examined: 8 ♂, 7 ♀.

EPITEDIA Jordan

Genotype: *Ctenophthalmus wenmanni* Rothschild 1904
Epitedia Jordan 1938, Nov. Zool. 41:124.

Resembles *Catallagia*, but with a genal ctenidium of two overlapping spines. Clypeal tubercle and notch present. Labial palpus of five segments, and only about two-thirds the length of fore coxa. A distinct sinus on the anterior dorsal margin of the pleurosternal plate where the cervical sclerite articulates with it (Pl. XIII, fig. 71). Coxa III with a row of spiniforms on its inner surface.

Tarsi V of fore and mid-legs with five pairs of plantar bristles, four of which are lateral, and one situated proximally, near the median line. Tarsus V of hind legs with four pairs of bristles, all lateral. Ventral arm of sternum IX in male with spiniforms.

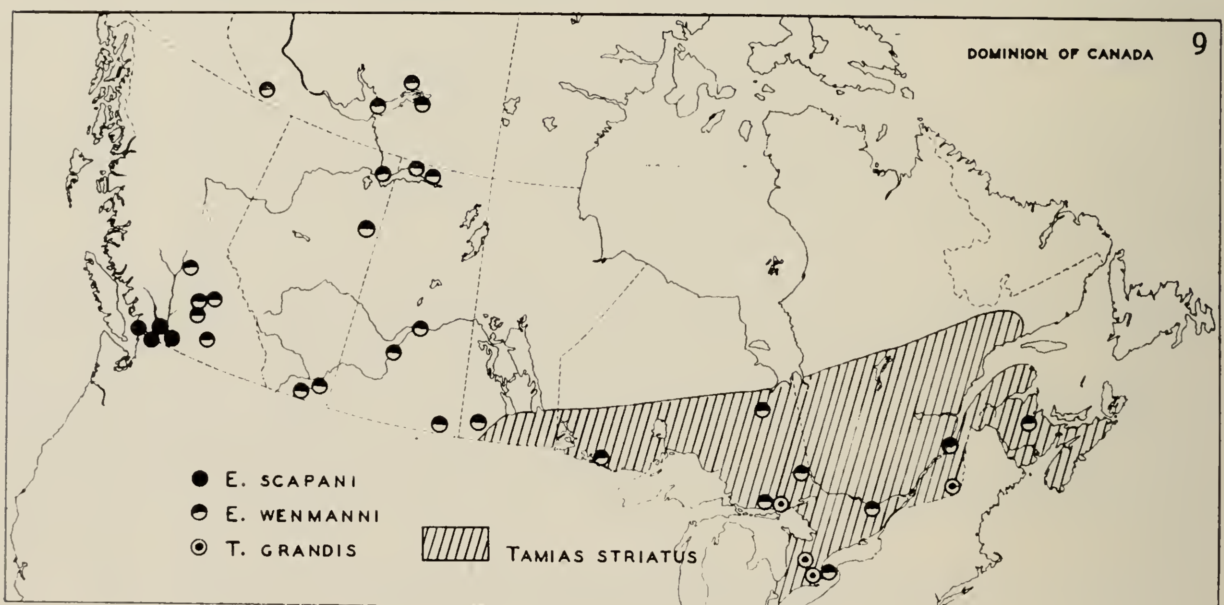
In the original description, the statement is made—"body of spermatheca longer than its tail . . . ., tail deeply projecting into lumen of body". These characters cannot hold in the generic diagnosis, if species now referred to this genus, and which differ in these respects, are to be included.

A nearctic genus, containing seven known species, of which two have been recorded in Canada. Preferred hosts are mice.

Key to the Canadian species of *Epitedia*

1. Found only in the extreme S. W. of British Columbia.
   ♂. P not bilobed (Pl. XIII, fig. 73)
   ♀. Tail of spermatheca not projecting into head (fig. 74) . . . . *scapani*

   Found from the east slopes of the Cascades, across the Dominion.
   ♂. P bilobed (fig. 76)
   ♀. Tail of spermatheca projecting deeply into lumen of head (fig. 77) . . . . *wenmanni*



MAP 9
Hystrichopsyllidae:Neopsyllinae. Locality records of *Tamiophila grandis* (Rothschild), (superimposed on the range of eastern shipmunks, *Tamias striatus* ssp., after Howell, 1929), *Epitedia scapani* (Wagner) and *E. wenmanni* (Rothschild).

EPITEDIA SCAPANI (Wagner)
(Plate XIII, figs. 71, 72, 73, 74; Map 9)

Neopsylla scapani Wagner 1936, Zeitsch. f. Parasitenk. 8(6):654,657; text-fig. 5. Male, from Vancouver, B. C., ex *Scapanus orarius*.

Epitedia (*Neopsylla*) *scapani* Wagner. Wagner 1940, Zeitsch. f. Parasitenk. 11(4):465; text-fig. 4. Female described, from University of British Columbia campus, Vancouver, B. C., ex *Scapanus orarius schefferi*.

Epitedia jordani Hubbard 1940, Pac. Univ. Bul. 37(2):10-11; figs. p. 9, synonym, fide Holland (1942:157-158).

Epitedia (=*Neopsylla*) *scapani* (Wagner). Holland 1941, Ent. Soc. B. C. Proc. 37:13. Recorded from British Columbia, as follows: Caulfeild, ex *Peromyscus maniculatus* ssp. (*austerus*); Chilliwack, ex *Scapanus townsendii* and *Sorex* sp.; Cultus Lake, ex *Mustela* sp.

Epitedia scapani (Wagner). Holland 1942, Can. Ent. 74(9):157-158. Synonymy of *E. jordani* Hubb. noted. Further British Columbia records: Agassiz, ex *Scapanus orarius schefferi;* Silver Creek (Hope), ex *Peromyscus m. oreas* and *Sorex* sp.; Gleneagles, ex *Peromyscus m. austerus;* Vancouver, ex *Neurotrichus g. gibbsii.*

Like a number of other species (*Corypsylla ornata*, *Nearctopsylla jordani*, and *Corrodopsylla curvata obtusata*), *E. scapani* appears, in Canada, to be confined to the extreme southwest of British Columbia. It is associated with the white-footed mouse, *Peromyscus*, and the Insectivora peculiar to the Pacific coast lowlands.

New Canadian records:

B.C.: Cultus Lake, 6.VI.45, ex *Microtus oregoni serpens*, 1 ♀ (G.P.H.)
Chilliwack, 15.VIII.44, ex *Aplodontia r. rufa*, 1 ♀ (H.G.F.)
Huntingdon, 14.III.43, ex *Sorex t. trowbridgii*, 1 ♀ (I.McT. C.)
Manning Park, VIII.45, ex *Peromyscus* sp., 1 ♀ (G.C.C.)
Vancouver, ex *Rattus norvegicus*, 1 ♂ (F.L.B.)

Specimens examined: 10 ♂, 26 ♀, including the holotype ♂ and 5 ♂ and 3 ♀ topotypes. Also two pairs of paratypes of Hubbard's "*Epitedia jordani*" (U. S. N. M.)

EPITEDIA WENMANNI (Rothschild)

(Plate XIII. figs. 75, 76, 77; Map 9)

Ctenophthalmus wenmanni Rothschild 1904, Nov. Zool. 11:642-643; pl. XIV, figs. 75,77,79. Both sexes from British Columbia (no specific locality) ex "*Peromyscus leucopus*" (*P. maniculatus* ssp.) and *Neotoma cinerea*.

Epitedia wenmanni (Rothschild). Jordan 1938, Nov. Zool. 41:124.

Epitedia wenmanni (Rothschild). I. Fox 1940, Fleas of Eastern U. S. pp. 96-98; pl. XXVII, figs. 139, 142, 144.

Epitedia wenmanni (Rothschild). Jameson 1943, Journ. Mammal. 24(2):195. Recorded from Welland Co., Ont., ex *Tamias striatus lysteri*.

Epitedia wenmanni (Rothschild). Baker 1946, Journ. Expt. Med. 84(1):47. Recorded from Grosse Isle, Que., ex *Microtus p. pennsylvanicus*, *Peromyscus m. gracilis* and *Condylura cristata nigra*.

The species is very widespread, ranging from the Atlantic seaboard westward to the Cascade Mountains of western British Columbia. It does not appear to occur in the Coast Forest Region or the Columbia Forest Region. On the other hand, we have records of it as far north as Great Slave Lake, and it has been taken as far south as New Mexico. While occurring on a variety of hosts, mostly small rodents, it appears to prefer the white-footed mouse, *Peromyscus* spp.

New Canadian records:

B.C.: Ewing's Landing, 15.X.41, ex *Mus musculus*, 1 ♀ (G.P.H.)
Kamloops, 14.III.41, ex *Peromyscus m. artemisiae*, 6 ♂, 3 ♀ (G.P.H.)
Jamieson Creek, 15.IX.45, ex *Peromyscus m. artemisiae*, 1 ♂, 1 ♀ (G.P.H.)
Lac du Bois, 27.VIII.39, ex *Peromyscus m. artemisiae*, 1 ♀ (G.J.S.)
Rayleigh, 5.II.41, ex nest of *Tamiasciurus h. streatori*, 1 ♂, 1 ♀ (G.P.H.); 29.III.44, ex *Peromyscus m. artemisiae*, 3 ♂, 2 ♀ (G.P.H.)
Williams Lake, 8.IV.44, ex *Peromyscus m.* ssp., 1 ♂, 1 ♀ (G.P.H.); 13.IV.44, ex nest of *Microtus p. drummondi*, 1 ♀ (G.P.H.)

Alta.: Chipewyan, 2.IX.45, ex *Tamiasciurus hudsonicus* ssp., 4 ♂ (W.F.)
Elkwater, 7.VI.40, ex *Zapus princeps minor*, 1 ♂ (G.P.H.)
Milk River, 26.V.40, ex *Peromyscus m. osgoodi*, 1 ♂, 1 ♀ (G.P.H.)
Waterways, 22.V.46, ex *Microtus* sp., 1 ♀ (W.F.)

Sask.: Crackingstone Point, ex *Peromyscus m.* ssp., 2 ♂, 2 ♀ (W.F.)
Emma Lake, 9.VIII.40, ex *Peromyscus m. borealis*, 1 ♂ (L.G.S.)
Estevan, VII.42, ex *Peromyscus m. osgoodi*, 2 ♀ (G.P.H.); 28.VI.42, ex *Microtus p. drummondi*, 1 ♂ (G.P.H.)
Fond du Lac, 16.VII.45, ex *Peromyscus m.* ssp., 1 ♂ (W.F.)
Saskatoon, 18.IV.44, ex *Citellus r. richardsonii*, 1 ♂ (W.F.); 20.IV.45, ex *Eutamias* sp. 1 ♀ (W.F.)
Shepley's Is., 11.X.43, ex *Peromyscus m.* ssp., 1 ♀ (W.F.)

Man.: Aweme, ex *Clethrionomys gapperi* ssp., 1 ♀ (N.C.); II.15, ex *Mustela erminea* ssp. 2 ♀ (S.C.)

Ont.: Algoma, 19.VIII.35, ex *Peromyscus m. gracilis*, 1 ♀ (C.H.D.C.)
Bell's Corners, 25.II.39, ex *Mustela erminea* ssp., 1 ♂, 1 ♀ (T.N.F.)
Chatham, 2.IV.41, ex *Microtus p. pennsylvanicus*, 1 ♂ (G.M.S.)
Kawene, VII.45, ex *Peromyscus m.* ssp., 2 ♂, 1 ♀ (A.C.B.)
Smoky Falls, 8.X.36, ex *Mus musculus*, 1 ♀ (R.V.W.); 7.XI.37, ex *Microtus p. pennsylvanicus*, 1 ♂ (R.V.W.)

N.B.: Scotch Lake, host unknown, 1 ♀

N.W.T.: Caribou Island, Great Slave Lake, 26.VI.46, 2 ♂, 4 ♀ (H.T.F.)
Fort Liard, III.45, ex *Peromyscus m.* ssp., 1 ♂, 2 ♀ (R.C.M.P.)
MacLeod Bay, Great Slave Lake, 17.VIII.44, ex *Peromyscus m.* ssp., 1 ♂ (P.L.)
Reliance, 15.IV.44, ex *Peromyscus m. borealis*, 1 ♂, 4 ♀ (R.C.M.P.)

Specimens examined 45 ♂, 50 ♀.

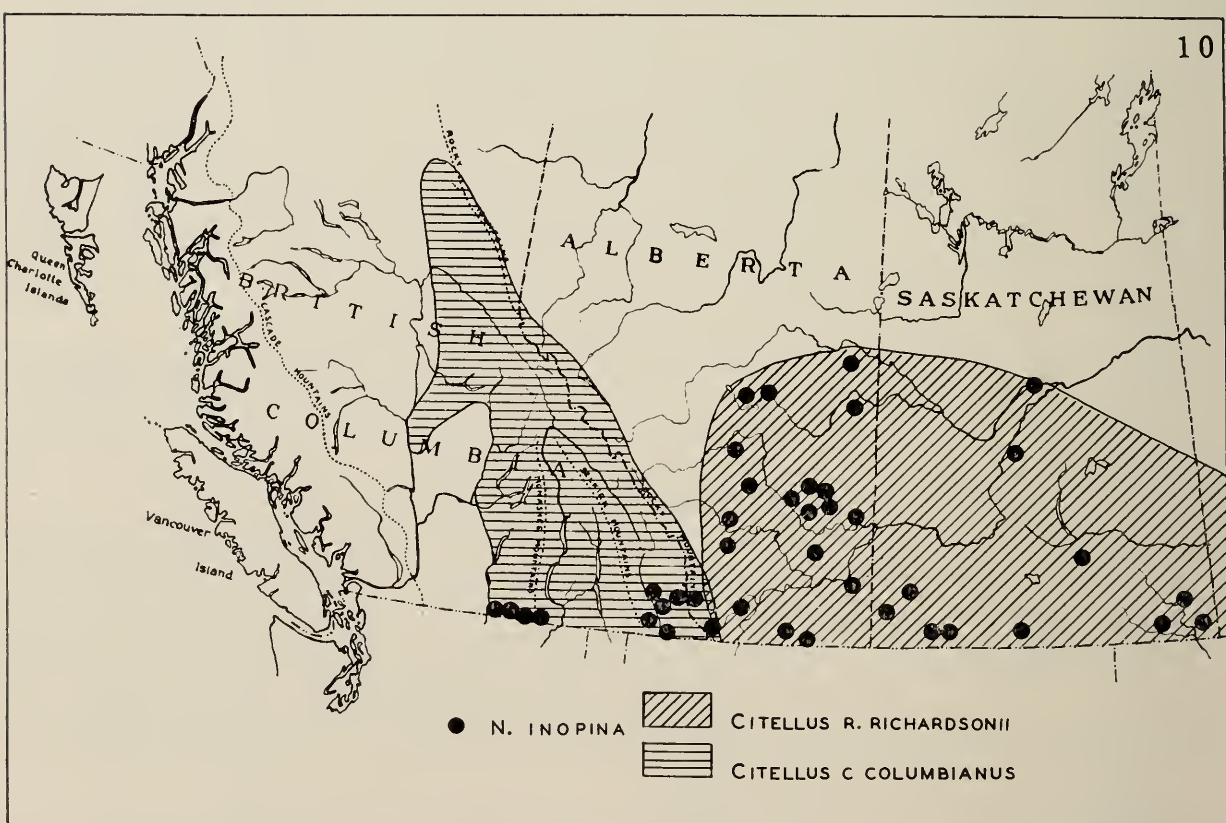
NEOPSYLLA Wagner

Genotype: *Typhlopsylla bidentatiformis* Wagner 1893. (palaearctic)
Neopsylla Wagner 1903, Horae Soc. Ent. Ross. 36:136,138.
Neopsylla Wagner. Rothschild 1915, Ectoparasites 1:30.

Cephalic setae and genal spines much as in *Epitedia*. A few thin setae on inside of coxa III, but no spinelets. Tarsus V of fore and mid legs normally with five pairs of plantar bristles, and tarsus V of hind legs with four. All these bristles are lateral in normal specimens. No ventral setae on basal abdominal sternum. No sinus where the cervical sclerite articulates with the pleurosternal plate (fig. 78).

Sternum IX of male with ventral marginal setae, but no pigmented spines.

A holarctic genus, with one species known from North America. Ewing and Fox (1943:78) have tentatively relegated this species (*N. inopina*) to *Epitedia* (although it does not conform to Jordan's or their own diagnosis of that genus) on the assumption that true *Neopsylla* is strictly palaearctic. They reserved final judgment pending comparison with the genotype of *Neopsylla*, *N. bidentatiformis* (Wagner). The writer feels that this action was unwarranted, and that there was not justifiable reason for questioning Jordan's exclusion of *inopina* from *Epitedia*. However, a large series of *inopina* has been compared with specimens of *N. bidentatiformis* and *N. setosa* (Wagner), another palaearctic species, at Kamloops, and the writer sees no evidence to warrant any assumption that they are not congeneric. The genus is associated with the mammal genus *Citellus* in the Old World and the New.



MAP 10

Hystrichopsyllidae:Neopsyllinae. Locality records of *Neopsylla inopina* Rothschild, superimposed on the range of ground squirrels, *Citellus r. richardsonii* and *C. c. columbianus*, modified after Howell 1938 by I. McT. Cowan and the writer.

NEOPSYLLA INOPINA Rothschild
(Plate XIII, figs. 78, 79, 80; Map 10)

Neopsylla inopina Rothschild 1915, Ectoparasites 1:30-32; figs. 32,33. Both sexes from Calgary, Alta., ex "*Spermophilus richardsoni*" (*Citellus r. richardsonii*), "*Putorius longicaudatus*" (*Mustela frenata longicauda*) and "*Evotomys saturatus*" (*Clethrionomys gapperi loringi*).

Neopsylla inopina Rothschild. Holland 1940, Ent. Soc. B. C. Proc. 36:11. Recorded from Kimberley, B. C., ex *Citellus columbianus*.

Epitedia inopina (Rothschild). Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:78.

Neopsylla inopina. Rothschild. (*Epitedia inopina* (Rothschild) Brown 1944, Ent. Soc. Amer. Annals. 37(2):209. Recorded from Waterton and Stanmore, Alta. Also, specimens recorded as *Tamiophila grandis* (Rothschild) from Stanmore, ex *Citellus columbianus* and *C. richardsonii*, examined by the writer through the courtesy of Mr. Brown, are, in his opinion, of this species.

N. inopina is typically a parasite of the Richardson's ground squirrel or "prairie gopher" of the plains of Alberta and Saskatchewan. In British Columbia, we only have records of it from the Kootenay district, where it occurs on the Columbian ground squirrel, *Citellus c. columbianus*.

New Canadian records:

B.C.: Cascade, 8.VI.40, ex *Citellus c. columbianus*, 1♂, 1♀ (S.P.Crew)
Corbin, 8.V.40, ex *C. c. columbianus*, 4♂, 1♀ (S.P.C.)
Cranbrook, 24.V.40, ex *C. c. columbianus*, 1♂ (S.P.C.)
Crow's Nest Pass, 16.V.40, ex *C. c. columbianus*, 1♂, 1♀ (S.P.C.)
Eholt, 15.VI.40, ex *C. c. columbianus*, 1♂, 1♀ (S.P.C.)
Fernie, 13.V.40, ex *C. c. columbianus*, 1♂, 2♀ (S.P.C.)
Ft. Steele, 1.V.40, ex *C. c. columbianus*, 2♂, 3♀ (S.P.C.)
Galloway, 7.V.40, ex *C. c. columbianus*, 1♂ (S.P.C.)
Grand Forks, 17.VI.40, ex *C. c. columbianus*, 1♂ (S.P.C.)
Newgate, 9.V.40, ex *C. c. columbianus*, 1♀ (S.P.C.)
Osoyoos, 25.VI.40, ex *C. c. columbianus*, 1♂ (S.P.C.)
Rock Creek, 21.VI.40, ex *C. c. columbianus*, 1♂, 1♀ (S.P.C.)
Roosville, 19.V.40, ex *C. c. columbianus*, 1♀ (S.P.C.)
Yahk, 24.IV.40, ex *C. c. columbianus*, 1♀ (S.P.C.)

Alta: Acadia Valley, 22.VI.44, ex *Citellus r. richardsonii*, 1♂, 1♀ (S.P.C.)
Aden, 13.VII.40, ex *C. r. richardsonii*, 1♂, 2♀ (G.P.H.)
Blairmore, ex *C. c. columbianus* (S.P.C.)
Brooks, 7.VI.40, ex *C. r. richardsonii*, 1♂, 1♀ (S.P.C.)
Camrose, VI.43, ex *C. r. richardsonii*, 1♂, 4♀ (S.P.C.)
Cereal, ex *C. r. richardsonii* (S.P.C.)
Delia, 31.V.40, ex *C. r. richardsonii*, 1♂, 1♀ (S.P.C.)
Hanna, 31.V.40, ex *Mustela f. longicauda*, 1♂ (S.P.C.); 1.VI.39, ex *Citellus r. richardsonii*, 2♂ (S.P.C.)
High River, 26.VII.38, ex *C. r. richardsonii*, 1♀ (G.P.H.)
Lake Newell, ex *C. r. richardsonii* (S.P.C.)
Medicine Hat, 9.V.43, ex *C. r. richardsonii*, 1♂ (S.P.C.)
Milk River, 15.V.40, ex *C. r. richardsonii*, 1♂, 1♂ (G.P.H.)
Oldman Lake, 29.V.40, ex *C. r. richardsonii*, 1♂, 1♀ (S.P.C.)
Red Deer, 15.VII.43, ex *C. r. richardsonii*, 1♀ (G.P.H.), ex *Mustela* sp. (E.T.)
San Francisco, 21.VII.44, ex *C. r. richardsonii*, 1♂ (S.P.C.)
Scotfield, 21.VI.40, ex *C. r. richardsonii*, 1♂, 1♀ (S.P.C.)
Suffield, VI.43, ex *C. r. richardsonii*, 3♂, 3♀ (S.P.C.)
Sunnynook, 8.VIII.40, ex *C. r. richardsonii*, 1♂, 1♀ (S.P.C.)
Three Hills, ex *C. r. richardsonii* (S.P.C.)
Vermilion, VI.43, ex *C. r. richardsonii*, 9♂, 7♀ (S.P.C.)
Wainwright, VI.43, ex *C. r. richardsonii*, 5♂, 5♀ (S.P.C.)
Wetaskiwin, 8.VII.43, ex *C. r. richardsonii*, 1♂, 2♀ (S.P.C.)

Sask.: Beaubier, 24.VII.43, ex *Citellus r. richardsonii*, 1♂, 1♀ (S.P.C.)
Big Beaver, 5.VIII.43, ex *C. r. richardsonii*, 1♂ (S.P.C.)
Carlyle Lake, 18.VIII.44, ex *Citellus franklinii*, 1♀ (W.F.)
Climax, 24.VIII.43, ex *C. r. richardsonii*, 1♂, 1♀ (S.P.C.)
Dundurn, 2.VII.43, ex *C. r. richardsonii*, 3♂, 5♀ (S.P.C.)
Estevan, VII.40, ex *C. r. richardsonii*, 7♂, 8♀ (G.P.H.)
Gainsborough, 10.VII.43, ex *C. r. richardsonii*, 2♂, 1♀ (S.P.C.)
Glen Ewen, 10.VII.43, ex *C. r. richardsonii*, 1♀ (S.P.C.)
Govenlook, 4.IX.43, ex *C. r. richardsonii*, 1♀ (S.P.C.)
Lake Alma, 25.VII.43, ex *C. r. richardsonii*, 1♂, 1♀ (S.P.C.)
Loomis, 1.IX.43, ex *C. r. richardsonii*, 2♀ (S.P.C.)
Maple Creek, 24.V.44, ex *Peromyscus m. osgoodi*, 1♂ (W.F.)
Norbury, V.45, ex *C. r. richardsonii*, 5♂, 13♀ (S.P.C.)
Outram, 14.VII.44, ex *C. r. richardsonii*, 1♀ (S.P.C.)
Prince Albert, 19.VI.43, ex *C. r. richardsonii*, 1♂ (S.P.C.)

Regina, VI.43, ex *C. r. richardsonii*, 1 ♂, 4 ♀ (S.P.C.)
Rock Glen, 9.VIII.43, ex *C. r. richardsonii*, 1 ♂, 3 ♀ (S.P.C.)
Saskatoon, 6.VI.41, ex *C. r. richardsonii*, 17 ♂, 22 ♀ (S.P.C.)
Val Marie, 8.VII.42, ex *Mustela f. longicauda*, 1 ♀ (G.P.H.)

Specimens examined: Large series of both sexes including 5 ♂ and 16 ♀ topotypes.

TAMIOPHILA Jordan

Genotype: *Typhlopsylla grandis* Rothschild 1902
Tamiophila Jordan 1938, Nov. Zool. 41:124.

Nearest *Neopsylla*, with which it agrees in most essentials, — tarsi V, general pattern of genitalia, reduction of spinelets on inside of coxa III, etc. Underside of basal abdominal sternum hairy. Size large (usually 4-5 mm. in length). Nearctic. One species known, occuring in the eastern United States and Canada.

TAMIOPHILA GRANDIS (Rothschild)

(Plate XIII, fig. 81; plate XIV, figs. 82, 83; Map 9)

Typhlopsylla grandis Rothschild 1902, Ent. Rec. and Journ. Var. 14:62-63; pl. II, fig. 3. Both sexes, from Branchton Ont., ex *Tamias striatus*.

Neopsylla striata Stewart 1926, Insec. Ins. Mens. 14:124-126. Synonym, fide Jordan (1929:172).

Neopsylla grandis (Rothschild). Wagner 1936, Can. Ent. 68(9):202. Recorded from Lennoxville, Que., ex *Tamias striatus*.

Tamiophila grandis (Rothschild). Jordan 1938, Nov. Zool. 41:124.

Tamiophila grandis (Rothschild). I. Fox 1940, Fleas of Eastern U. S. pp. 100-101; pl. 25, figs. 127,129,131.

Tamiophila grandis (Rothschild). Jameson 1943, Journ. Mammal. 24(2):195. Recorded from Welland Co., Ont., ex *Tamias striatus lysteri* and *Sylvilagus floridanus mearnsi*.

Tamiophila grandis (Rothschild). Brown 1944, Ent. Soc. Amer. Annals 37(2):210. Recorded erroneously from Alberta. Specimens were *Neopsylla inopina* (see).

Wagner (1936:202) suggested that this species would be found in British Columbia, on *Tamias*. This does not seem probable to the present writer as the eastern chipmunk, which is undoubtedly the true host and principal distribution-controlling factor of this flea, does not occur this far west. *Tamias* is not known west of Manitoba in Canada.

New Canadian records:

Ont.: Buckshot Lake, 21.VII.32, ex "chipmunk", 1 ♀ (C.H.D.C.)
Ottawa, 11.IX.35, ex *Tamias striatus* ssp., 1 ♀ (C.H.D.C.)
Pancake Bay, Algoma, 3.IX.35, ex *Tamias striatus griseus*, 1 ♂ (C.H.D.C.)
Rockcliff Pk., 15.V.34, ex cottontail rabbit, 1 ♂ (H.L.)

Specimens examined: 3 ♂, 3 ♀.

MERINGIS Jordan

Genotype: *Phalacropsylla arachis* Jordan 1929
Meringis Jordan 1937, Nov. Zool. 40:268-269.

This genus and one other (*Phalacropsylla*, not recorded from Canada) are distinguished from all other *Neopsyllinae* by the lack of a clypeal tubercle, and having all tarsi V with four pairs of lateral plantar bristles and a proximal ventral pair (Pl. XIV, fig. 85). *Meringis* is further distinguished by the lack of apical spinelets on the abdominal terga, and the possession of a nearly flat pygidium.

Coxa III with a row of spinelets on inner surface. Ventral arm of sternum IX in the male complex, and bearing some heavily pigmented spiniforms. Head of the spermatheca in the female inverted pyriform.

The genus (strictly nearctic) of which there are eight species recognized to date in North America, is characteristically parasitic on Kangaroo rats (*Dipodomys* spp.) and pocket mice (*Perognathus* spp.). One species is known at present from Canada, and it is recorded from the Okanagan valley in British Columbia only. It is quite probable that at least one more species (perhaps *M. parkeri* Jordan) will be found in Alberta, Saskatchewan and Manitoba, where pocket mice and/or kangaroo rats occur.

MERINGIS SHANNONI (Jordan)
(Plate XIV, figs. 84, 85, 86, 87, 88; Map 8)

Phalacropsylla shannoni Jordan 1929, Nov. Zool. 35:38-39; pl. II, figs. 28,29. Both sexes from Ritzville, Washington ex "field mice" (*Microtus*) and Lind, Washington, ex *Perognathus* and "big-eared mice" (*Peromyscus?*).

Meringis shannoni (Jordan). Jordan 1937, Nov. Zool. 40:269.

Meringis shannoni (Jordan). Holland 1941, Ent. Soc. Brit. Col. Proc. 37:13. Recorded from Okanagan Landing, B. C., ex "*Perognathus l. lordi*" (*P. parvus laingi*) and *Peromyscus m. artemisiae*.

The species is known only from part of southern British Columbia where two races of *Perognathus parvus* occur.

New Canadian records:

B.C.: Anarchist Mountain, 28.V.41, ex *Perognathus parvus laingi*, 1 ♀ (I.McT. C.)
Osoyoos, 21.V.41, ex *Perognathus parvus lordi*, 1 ♂ (I.McT.C.)
Vernon, 3.VI.41, ex *Perognathus p. laingi*, 2 ♂, 4 ♀ (G.C.C.)

Specimens examined: 5 ♂, 8 ♀, including the type ♂ and a paratype ♀ (U. S. N. M.)

Subfamily C. RHADINOPSYLLINAE Wagner 1930.

Eyes vestigial. Genal ctenidium of strong spines typically present, but lacking, or at most represented by vestigial spinelets in one genus (fig. 100). Metepimerum with a densely striated patch in all Canadian genera (figs. 90, 97 and 101). Anterior dorsal corner of metasternum acutely rounded, and directed upwards. Two rows of setae (one may be somewhat reduced) to each abdominal tergum. Pygidium convex. Females with two subequal antepygidial setae; males with none, or at most a single, thin, undifferentiated seta. Genitalia of males without pigmented spines. Preferred hosts are small rodents.

Five nearctic genera, all but two of which *(Actenophthalmus* and *Paratyphloceras)* have been recorded from Canada.

MICROPSYLLA Dunn and Parker

Genotype: *Micropsylla peromyscus* Dunn 1923 (a synonym of *Rhadinopsylla sectilis* Jordan and Rothschild 1923).

Micropsylla Dunn and Parker 1923, Pub. Hlth. Repts. 38:2767.

Micropsylla Dunn and Parker. Jordan 1937, Nov. Zool. 40:270.

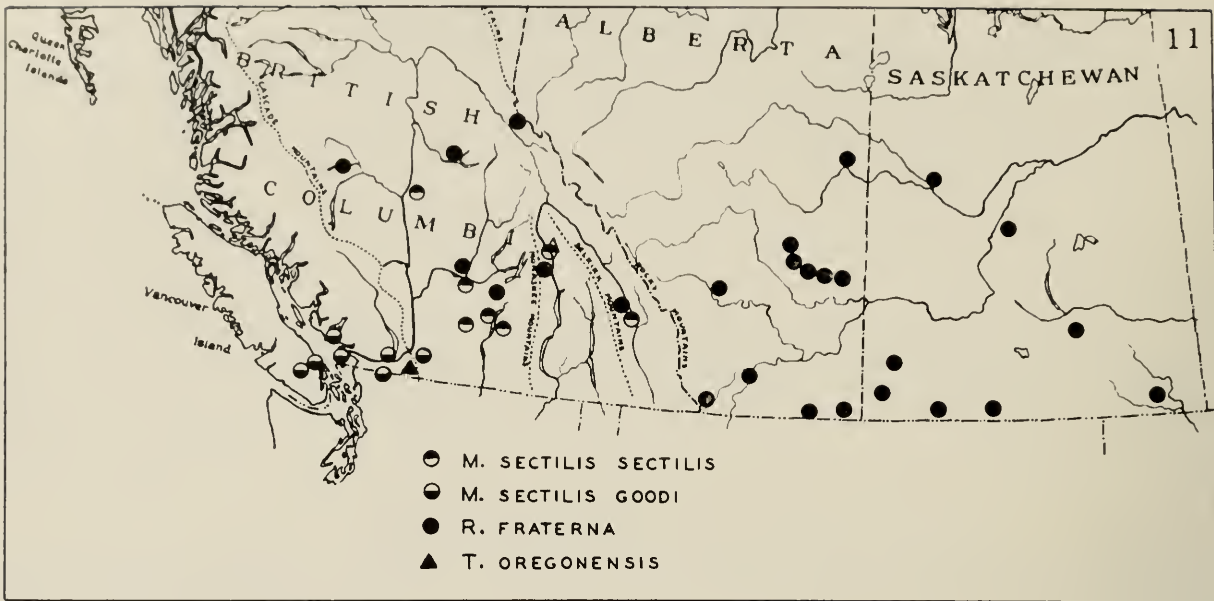
Clypeal tubercle acuminate. Genal comb normally of 4 to 5 strong, blunt spines, but varying in individuals from 3 to 6. Metanotum not divided by transverse ridge (Pl. XIV, fig. 90). Inside of hind coxa with patch of thin spinelets.

The genus is known only from North America, west of the Rocky Mountains. Mice, especially *Peromyscus* spp. appear to be the true hosts of these very small fleas. From the limited collection data at hand, it would seem that the winter and spring months represent the principal season of activity. Most probably they are chiefly nest fleas in any case.

Two species have been described, but a study of Canadian material leads the present writer to feel that the differences stated are not of full specific value, for individuals from the same locality may sometimes show considerable variation, making determination difficult, if the collection site were not known. Therefore, the two forms are regarded here as geographical subspecies or races of *Micropsylla sectilis* (Jordan and Rothschild), separated distributionally by the Cascade Mountains.

Key to the subspecies of *Micropsylla sectilis*

1. Occurring west of the Cascade Mountains only.
Genal ctenidium normally of 5 spines (4-6) (Pl. XIV, fig. 94)
♂. Apex of F normally only very slightly notched (fig. 95)
♀. Sternum VII only slightly incised (fig. 96) . . . . *sectilis goodi*
East of the Cascades to the Rockies.
Genal ctenidium normally of 4 spines (3-5) (Pl. XIV, fig. 89)
♂. F a little longer and with the apical notch a little more noticeable (figs. 91, 92).
♀. Sternum VII more deeply incised (fig. 93) *sectilis sectilis*



MAP 11

Hystrichopsyllidae:Rhadinopsyllinae. Locality records of *Micropsylla sectilis sectilis* (Jordan and Rothschild), *M. s. goodi* Hubbard, *Rectofrontia fraterna* (Baker) and *Trichopsylloides oregonensis* Ewing.

MICROPSYLLA SECTILIS SECTILIS (Jordan and Rothschild)

(Plate XIV, figs. 89, 90, 91, 92, 93; Map 11)

Rhadinopsylla sectilis Jordan and Rothschild 1923 (Nov. 20), Ectoparasites 1:314-315; text-fig. 318. Females from Kelowna, British Columbia, ex "*Peromyscus* sp." (*P. maniculatus artemisiae*) and *Mus* sp.

Micropsylla peromyscus Dunn 1923 (Nov. 23), Pub. Hlth. Repts. 38:2767-2768, 2775. Synonym, fide Jordan (1937: 270).

Micropsylla sectilis (Jordan and Rothschild). Jordan 1937, Nov. Zool. 40:270.

Micropsylla sectilis (Jordan and Rothschild). Hubbard 1941, Pac. Univ. Bul. 37(10):1-3; figs.

Micropsylla sectilis (Jordan and Rothschild). Jellison and Good 1942, Nat. Inst. Hlth. Bul. 178:86.

This flea is not common on host animals, even in the early spring, which seems to be the season of principal activity.

New Canadian records:

B.C.: Eagle Pass, Revelstoke, 8.V.46, ex *Peromyscus*, 3♂, 3♀ (G.P.H.)
Ewing's Landing, 18.X.46, ex nest of *Tamiasciurus hudsonicus streatori*, 1♂ (W.H.)
Kamloops, 1.IV.44, ex *Peromyscus m. artemisiae*, 1♀ (G.P.H.); 18.I.45, ex *Mus musculus*, 1♂ (G.P.H.)
Kelowna, 10.IV.40, ex *Citellus c. columbianus*, 1♂ (S.P.Crew)
Quilchena, 22.VI.45, ex *Peromyscus m. artemisiae*, 1♀ (G.P.H.)
Williams Lake, 8.IV.44, ex *Peromyscus m.* ssp. 3♂, 3♀ (G.P.H.)
Windermere, 22.VII.40, ex *Citellus, c. columbianus*, 1♂ (S.P.Crew)

Specimens examined: 10♂, 10♀, including 2♂ and 2♀ topotypes.

MICROPSYLLA SECTILIS GOODI Hubbard

(Plate XIV, figs. 94, 95, 96; Map 11)

Rectofrontia sectilis Jordan and Rothschild. Wagner 1936, Can. Ent. 68(9):203, pl. II, figs. 8,9. Male described from Vancouver, B. C., ex "*Peromyscus m. austreus*" (*P. m. austerus*).

Micropsylla goodi Hubbard 1941, Pac. Univ. Bul. 37(10):1-4; figs. Described from a series of 70 specimens, all collected west of the Cascade Mts. in Oregon and Washington, mostly from *Peromyscus* spp.

The stated diagnosis separates this flea from true *sectilis*, which is known only from territory lying east of the Cascades, chiefly on the number of genal spines and the absence of an apical notch on F. Specimens in this collection show that F in the males is on the average shorter than in *sectilis*, but has a slight notch. Also, the number of genal spines tends to be variable, some individuals having 5 spines on one side and 4 on the other. Sometimes 6 are present. One specimen bears 4 on each side, like true *sectilis*. In the writer's opinion, *goodi* should be considered no more than a western subspecies of *sectilis*.

Hubbard (1941:4) mentions that Wagner's record (1936:203) from Vancouver British Columbia refers to *goodi*.

New Canadian records:

B.C.: Cowichan Lake, 16.III.41, ex *Mustela erminea anguinae*, 1 ♀ (J.H.)
Gambier Island, 21.II.43, ex *Peromyscus m. austerus* 1 ♀ (I.McT.C.); 21.II.43, ex *Tamiasciurus douglassi mollipilosus*, 1 ♀ (I.McT.C.)
Harrison Bay, 8.V.40, ex *Peromyscus m.* ssp., 1 ♂ (J.D.G.); 8.IV.41, ex *Peromyscus m.* ssp., 1 ♀ (J.D.G.)
Huntingdon, 28.II.43, ex *Peromyscus m. austerus*, 1 ♂ (I.McT.C.); III.41, ex *Microtus oregoni serpens*, 1 ♂, 1 ♀ (I.McT.C.)
Silver Creek, 22.IV.42, ex *Peromyscus m. oreas*, 2 ♂, 1 ♀ (J.D.G.)
Vancouver, 1.XI.40, ex *Spilogale gracilis olympica*, 1 ♂ (I.McT.C.); ex *Rattus norvegicus*, 1 ♂ (F.L.B.)
Yellow Point, V.I., 30.XII.44, ex *Peromyscus m.* ssp., 1 ♂ (A.C.B.)

Specimens examined: 14 ♂, 12 ♀ including the types, and 2 ♂ and 1 ♀ paratype (U. S. N. M.)

RECTOFRONTIA Wagner and Argyropulo

Genotype: *Typhlopsylla pentacanthus* Rothschild 1897 (palaearctic)
Rhadinopsylla (*Rectofrontia*) Wagner 1930, Kat. d. Palaearktisch. Anphanipt.:32 (used as a subgenus)
Rectofrontia Wagner and Argyropulo 1934, Zeitsch. f. Parasitenk. 7:230-231.

Much like *Micropsylla*, but with the lower portion of the metanotum separated by a transverse ridge (Pl. XV, fig. 97). Coxa III with a patch of thin spinelets on inner surface. Holarctic. One nearctic species known, which occurs in Canada.

RECTOFRONTIA FRATERNA (Baker)

(Plate XV, figs. 97, 98, 99; Map 11)

Typhlopsylla fraterna Baker 1895, Can. Ent. 27:189-190. Both sexes from Lansing, Michigan ex "garden mole (*Scalopus aquaticus*).
Ctenophthalmus fraternus (Baker). Baker 1904, U. S. Nat. Mus. Proc. 27:420, 423-424, 450.
Neopsylla hamiltoni Dunn 1923, Pub. Hlth. Repts. 38:2770-2771, 2775. Synonym, fide Jordan (1937:270).
Rectofrontia fraterna (Baker). Jordan 1937, Nov. Zool. 40:270. Mentions specimens from Alberta and British Columbia, and Saskatoon (Saskatchewan).
Rectofrontia fraterna (Baker). Holland 1940, Ent. Soc. B. C. Proc. 36:11. Recorded from Waterton Lakes Park, Alta, ex *Citellus c. columbianus*.
Rectofrontia fraterna (Baker). Brown 1944, Ent. Soc. Amer. Annals 37(2):210. Recorded from Dobson, Alta, ex *Speotyto cunicularia*.

Of widespread distribution in North America. Recorded from Maryland (Fox 1940:39) to British Columbia. In Alberta and Saskatchewan it occurs chiefly on the Richardson's ground squirrel, and is quite common. In British Columbia, *R. fraterna* appears to be somewhat rare, and occurs on a variety of hosts, such as pikas, tree squirrels, woodrats, etc. In the few males available from British Columbia, the moveable process (F) appears to be proportionately slightly longer than in specimens from east of the Rockies. Also, the ventral arm of sternum IX is somewhat narrower. These specimens may represent a western subspecies, but decision is being withheld, pending further collections.

New Canadian records:

B.C.: Begbie Mt., 7.VIII.41, ex *Ochotona princeps* ssp., 1 ♂, 1 ♀ (G.P.H.)
Berg Lake, Mt. Robson, 28.VII.44, ex *Neotoma cinerea drummondi*, 1 ♂ (G.P.H.)
Jamieson Creek, 14.X.46, ex nest (mouse ?) 2 ♂, 3 ♀ (J.D.G.)
Paradise Mine, 26.VIII.44, ex *Phenacomys intermedius* ssp., 1 ♂ (G.P.H.)
Quesnel Lake, XII.44, ex *Martes americana*, 1 ♂ (E.S.K.)
Robbin's Range, 22.IV.40, ex *Ochotona p. brooksi*, 1 ♂ (G.P.H.)
Tatla Lake, 28.III.41, ex *Tamiasciurus hudsonicus* ssp., 1 ♂ (G.P.H.)

Alta.: Aden, XI.40, ex *Mustela frenata longicauda*, 1 ♂, 1 ♀ (J.G.)
Calgary, 28.VI.40, ex *Citellus r. richardsonii*, 1 ♀ (G.P.H.)
Coronation, 6.VIII.40, ex *C. r. richardsonii*, 1 ♂ (S.P.Crew)
Delia, 31.V.40, ex *C. r. richardsonii*, 2 ♀ (S.P.C.)
Hanna, 1.VI.39, ex *C. r. richardsonii*, 1 ♂ (S.P.C.)
Lethbridge, host not recorded, 5 ♀ (A.E.C.)
Manyberries, 4.VI.40, ex *Peromyscus m. osgoodi*, 1 ♂ (G.P.H.)
Scotfield, 21.VI.40, ex *Citellus r. richardsonii*, 1 ♀ (S.P.C.)
Stanmore, VI.40, ex *C. r. richardsonii*, 5 ♂, 3 ♀ (S.P.C.)
Vermilion, 6.VI.43, ex *C. r. richardsonii*, 1 ♂ (G.P.H.)

Sask.: Cavalier (N. Battleford), 22.IX.46, ex *C. r. richardsonii*, 4♂, 4♀ (W.F.)
Climax, ex *C. r. richardsonii* (S.P.C.)
Consul, ex *C. r. richardsonii* (G.P.H.)
Estevan, 20.VII.42, ex *Mustela f. longicauda*, 1♀ (G.P.H.)
Frontier, 31.VIII.43, ex *C. r. richardsonii*, 1♀ (S.P.C.)
Govenlock, 8.IX.43, ex *C. r. richardsonii*, 1♂ (S.P.C.)
Maple Creek, 27.V.43, ex *C. r. richardsonii*, 1♀ (S.P.C.)
Rock Glen, 30.VIII.44, ex *C. r. richardsonii*, 2♂, 1♀ (S.P.C.). 10.IX.42, ex *Onychomys leucogaster missouriensis*, 4♂, 11♀ (W.F.)
Regina, XII.33, ex Jack rabbit, 1♀ (F.B.)
Saskatoon, ex *C. r. richardsonii* (L.G.S.); 10.V.40, ex *Mustela frenata longicauda*, 2♂ (L.G.S.)

Specimens examined: 31♂, 47♀.

TRICHOPSYLLOIDES Ewing

Genotype: *Trichopsylloides oregonensis* Ewing 1938
Trichopsylloides Ewing 1938, Ent. Soc. Wash. Proc. 40:94.
Phaneris Jordan 1939, Nov. Zool. 41:317.
Trichopsylloides Ewing. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:19.

Eyes completely lacking. Normally without genal ctenidium, but the occasional specimen with a vestige of this structure (Pl. XV, fig. 100). Transverse ridge partially dividing metanotum (fig. 101). Setae of abdomen peculiarly long and hair-like. Apical spinelets present on some of the abdominal terga (stated to be absent in the original description). Two antepygidial bristles in the female (fig. 103), of about the same thickness and length as other tergal setae. (Ewing and Fox (1943:19) state "antepygidial bristles either undifferentiated from other nearby setae or but slightly differentiated". In the type of *T. oregonensis* they are stated to be absent or not clearly defined. In the description of *Phaneris hubbardi*, a synonym, they are clearly shown in fig. 269. In the two females available to the present writer, they are also clearly discernible.) No antepygidial setae in the males. No spiniforms on inside of hind coxae.

There is some controversy over the systematic position of this genus. Ewing and Fox (1943:19) associating it with *Arctopsylla* and *Chaetopsylla* in the *Vermipsyllinae* (treated as a subfamily of the *Dolichopsyllidae*). Jordan (1939:317-318) in his description of *Phaneris*, a synonym, associates the genus with *Rectofrontia*. In view of the structure of the thorax, the sexual dimorphism with reference to antepygidial setae, and other points of similarity, especially in the pattern of the genitalia, the present writer concurs with the latter interpretation.

The genus is strictly nearctic, and peculiar to the "mountain beaver" (*Aplodontia* spp.) or its predators. One (possibly two ?) species known.

TRICHOPSYLLOIDES OREGONENSIS Ewing

(Plate XV, figs. 100, 101, 102, 103; Map 11)

Trichopsylloides oregonensis Ewing 1938 Ent. Soc. Wash. Proc. 40:94. Both sexes from Delake, Oregon (type locality) and Greathorn Creek, Washington, ex "*Aplodontia pacifica*" (*A. rufa p.*).

Phaneris hubbardi Jordan 1939, Nov. Zool. 41:318-319; text-figs. 268,269. From Springwater, Oregon, ex *Aplodontia rufa* ssp. synonym, fide Hubbard (1940:4).

Trichopsylloides oregonensis Ewing. Holland 1941, Ent. Soc. B. C. Proc. 37:11. Recorded from Cultus Lake, B. C. ex *Mustela vison energumenos*.

Ewing and Fox (1943:19) are tentatively allowing the species *oregonensis* and *hubbardi* to stand as distinct, in view of the stated absence of antepygidial bristles in *oregonensis* (visible to writer, who examined type ♀ in U.S.N.M., 7.IX.47) and the presence of such in *hubbardi*. In addition, "the upper sclerite of the metepisternum" is stated to be "more clearly demarcated from the metanotum in *hubbardi*". Further study, with an abundance of material may prove this difference to be within the limits of individual variation.

We have no further Canadian records of this most interesting and highly modified flea.

Specimens examined: 1♂ from Canada. The type series (2♂, 1♀, U. S. N. M.). Also 1♀ from Tillamook Co., Oregon, ex *Aplodontia*, kindness of Wm. L. Jellison, and 1♂, 1♀ from Clastrop Co., Oregon, ex *Aplodontia rufa pacifica*, received from F. M. Prince.

Subfamily D. CTENOPHTHALMINAE Rothschild 1915.

A subfamily in the interpretation and scope of which there has been no general agreement. As considered here, it is limited to genera having the following combination of characters.

Belonging to that section of the family that has the metasternum rounded dorsally, with the upper margin more or less horizontal, but distinguished from the Hystrichopsyllinae, Anomiopsyllinae and Nearctopsyllinae by a number of characters, including the nature of the genal ctenidium, which is located ventrally, and usually nearly horizontal.

Coxa III without a patch of spinelets on the inner surface. No striarium on thorax or abdomen. Antepygidial setae present in both sexes.

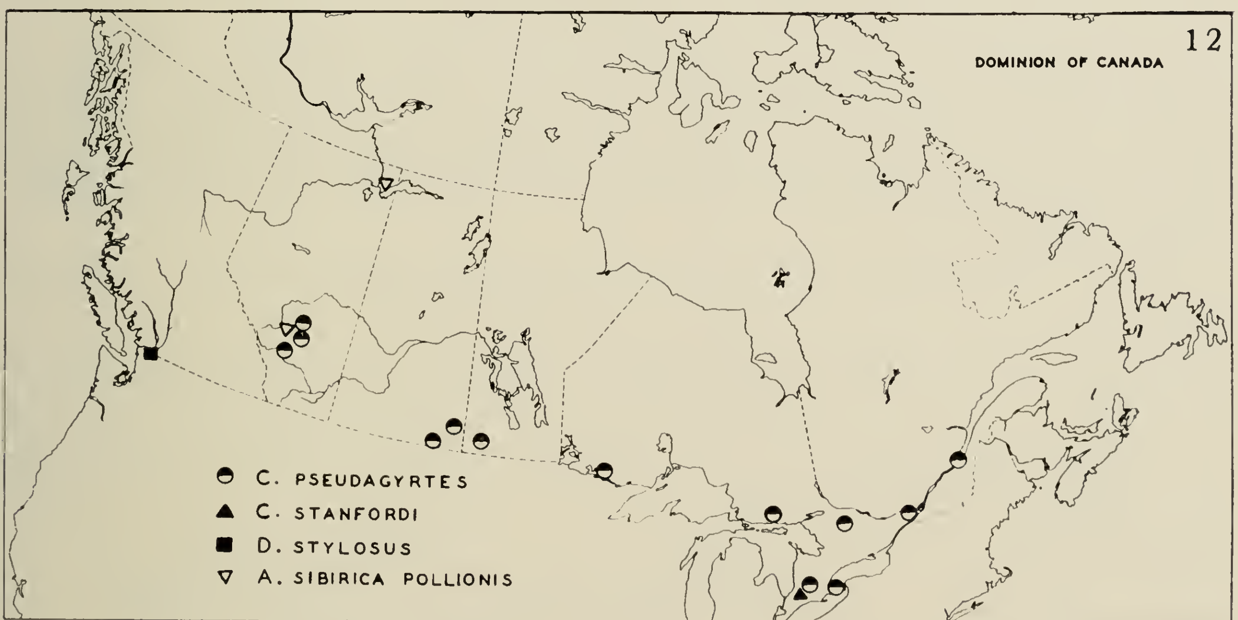
Five nearctic genera, of which all but *Carteretta* and *Tritopsylla* occur in Canada. Most of the species are associated with Insectivora and small Rodentia.

CTENOPHTHALMUS Kolenati

Genotype: *Ctenophthalmus bisoctodentatus* Kolenati 1863 (palaearctic).
Ctenophthalmus Kolenati 1856, Die Parasiten der Chiropteren:33.
Ctenophthalmus Kolenati. I. Fox 1940, Fleas of Eastern U. S., p. 34.

Head intermediate with regard to interantennal division. Eyes vestigial. Clypeal tubercle prominent. No trabecula centralis. Genal ctenidium of three closely appressed sharp spines, directed ventrocaudad (Plate XVI, fig. 104). A curved apical bristle on the distal segment of the labial palpus (fig. 105). Tarsi V of fore and mid legs with four pairs of lateral plantar bristles, and a basal submedian pair. Tarsus V of hind legs with three lateral pairs and a proximal subventral pair.

The genus is holarctic, being represented by a great variety of species and subspecies in Europe and Asia, and by a single known North American species, which occurs in Canada, east of the Rocky Mountains.



MAP 12

Hystrichopsyllidae:Ctenophthalminae. Locality records of *Ctenophthalmus pseudagyrtes* Baker. Anomiopsyllinae; records of *Conorhinopsylla stanfordi* Stewart. Ceratophyllidae: Dolichopsyllinae; record of *Dolichopsyllus stylosus* (Baker). Amphipsyllinae; records of *Amphipsylla sibirica pollionis* (Rothschild).

CTENOPHTHALMUS PSEUDAGYRTES Baker

(Plate XVI, figs. 104, 105, 106, 107; Map 12)

Ctenophthalmus pseudagyrtes Baker 1904, U. S. Nat. Mus. Proc. 27:420-421,423,451; pl. XI, figs. 7-12. Both sexes from Agricultural College, Michigan (type locality), ex *Geomys bursarius*. Also from Ames, Iowa, ex "*Scalops argentatus*" (*Scalopus aquaticus machrinus*); Ithaca, New York, ex nest of field mouse; Wellesley, Massachusetts, ex "*Megascops asio*" (*Otus asio*).

Ctenophthalmus pseudagyrtes Baker. Rothschild 1904, Nov. Zool. 11:641-642; pl. XIV, figs. 73,78; pl XV, fig. 81 Recorded from Red Deer, Alta, ex "*Microtus drummondi*" (*M. pennsylvanicus d.*) and *M. saturatus*" (*Clethrionomys gapperi loringi*).
Ctenophthalmus pseudagyrtes Baker. I. Fox 1940, Fleas of Eastern U. S. pp. 34-38; pl. X, figs. 45,46,49.
Ctenophthalmus pseudagyrtes Baker. Jameson 1943, Journ. Mammal. 24(2):194-196. Recorded from Welland Co., Ont., ex *Parascalops breweri*, *Pitymys pinetorum scalapsoides*, *Blarina brevicauda talpoides* and *Microtus p. pennsylvanicus*.
Ctenophthalmus pseudagyrtes Baker. Baker 1946, Journ. Expt. Med. 84(1):47. Recorded from Grosse Isle, Que., ex *Microtus p. pennsylvanicus*, *Temiasciurus hudsonicus gymnicus* and *Condylura cristata nigra*.

The species is widespread across temperate North America, from the Atlantic westward to the Rockies, which apparently limit the range westward. Mice and insectivores are the favoured hosts.

New Canadian records:

Alta.: Blackfalds, 22.VI.40, ex *Peromyscus m. borealis*, 1♂, 2♀ (G.P.H.)
Calgary, 21.VII.43, ex *Citellus r. richardsonii*, 1♂ (S.P.Crew)
Sask.: Carlyle Lake, 19.VII.44, ex *Peromyscus m. borealis*, 2♂, 1♀ (W.F.); 24.VI.42, ex *Clethrionomys gapperi* ssp., 3♂, 2♀ (G.P.H.)
Estevan, 23.VII.42, ex *Microtus p. drummondi*, 1♂ (G.P.H.)
Man.: Aweme, 19.X.13, ex *Clethrionomys gapperi*, 1♂ (N.C.)
Ont.: Algoma, 9.VIII.35, ex *Eutamias* sp., 1♀ (C.H.D.C.); 22.VIII.35, ex *Tamiasciurus hudsonicus* ssp., 1♂ (C.H.D.C.); 30.VIII.35, ex *Condylura c. cristata*, 2♂, 5♀ (C.H.D.C.); 2.IX.35, ex *Clethrionomys gapperi* ssp., 1♀ (C.H.D.C.); 1.VIII.35, ex *Parascalops breweri*, 1♂ (C.H.D.C.); 12.IX.35, ex *Blarina brevicauda talpoides*, 1♀ (C.H.D.C.)
Apple Hill, 2.VII.38, ex *Condylura c. cristata*, 1♂, 4♀ (G.H.H.)
Bigger Lake, 24.VIII.35, ex *Eutamias minimus*, 1♀ (C.H.D.C.)
Brule Lake, VII-VIII.34, ex *Parascalops breweri*, 15♂, 14♀ (C.H.D.C.); 7.VIII.34, ex *Sorex cinereus*, 1♂ (C.D.F.)
Chatham, IV.41, ex *Peromyscus leucopus noveboracensis*, 2♀ (G.M.S.)
Kawene, VII.45, ex *Peromyscus* sp., 1♂ (A.C.B.)
London, 6.X.30, ex *Parascalops breweri*, 1♀ (E.D.)

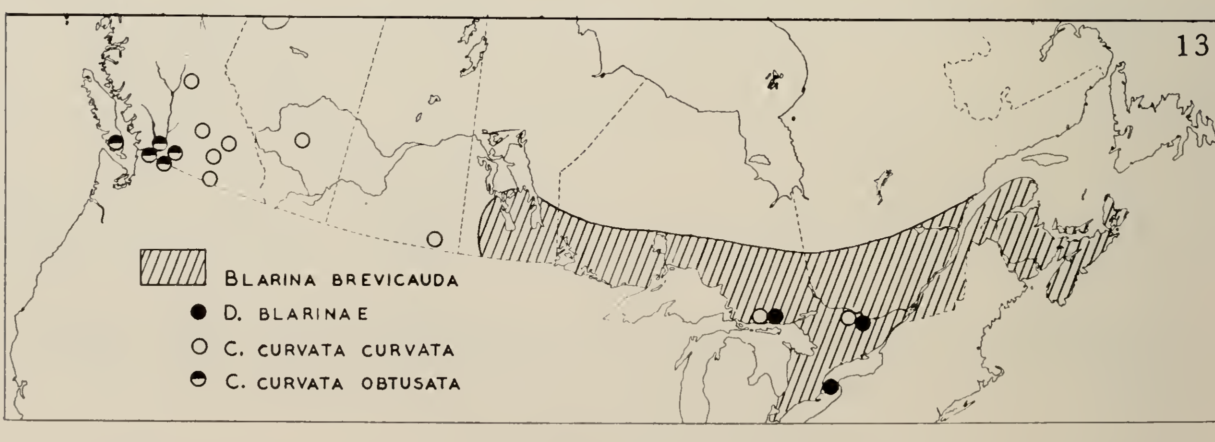
Specimens examined: 36♂, 35♀.

DORATOPSYLLA Jordan and Rothschild

Genotype: *Typhlopsylla dasycnemus* Rothschild 1897. (palaearctic)
Doratopsylla Jordan and Rothschild 1912, Nov. Zool. 19:62.
Doratopsylla Jordan and Rothschild. Rothschild 1915, Ectoparasites 1:25.
Doratopsylla Jordan and Rothschild. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:81-82.

Genal ctenidium of four spines of which the most posterior is closely appressed to the genal border, and partly covers the genal process (Pl. XVI, fig. 108). Tergum VII not produced into processes extending posteriorly between the two sets of antepygidial bristles (fig. 109); cf. next genus, fig. 112). Labial palpus of four segments. Four lateral pairs and one proximal ventral pair of plantar bristles on all tarsi V.

An holarctic genus, one species occurring in North America, including Canada.



MAP 13

Hystrichopsyllidae:Ctenophthalminae. Locality records of *Doratopsylla blarinae* C. Fox (superimposed on range of short-tailed shrews, *Blarina brevicauda*, as outlined by A. L. Rand. National Museum of Canada), *Corrodopsylla curvata curvata* (Rothschild) and *C. c. obtusata* (Wagner).

DORATOPSYLLA BLARINAE C. Fox

(Plate XVI, figs. 108, 109, 110; Map 13)

Doratopsylla blarinae C. Fox 1914. U. S. P. H. Hyg. Lab. Bul. 97:11; pl. 4, figs. 1-3. Male, from Washington D. C., ex *Blarina brevicauda*.

Doratopsylla blarinae Fox. Chapin 1919 Brookl. Ent. Soc. Bul. 14:54:55. Female described, from Plummer Island, Maryland, ex *Blarina brevicauda*.

Doratopsylla blarinae C. Fox. I. Fox 1940, Fleas of Eastern U. S., pp. 92-94; pl. XXVI, figs. 134, 135, 137.

Doratopsylla blarinae C. Fox. Jameson 1943, Journ. Mammal. 24(2):195. Recorded from Welland Co., Ont., ex *Blarina brevicauda talpoides*.

The short-tailed shrew, *Blarina*, is undoubtedly the true host of this flea, which is confined to part of the range of that mammal, in eastern North America.

New Canadian records:

Ont.: Brule Lake, Algonquin Pk., VII-VIII.34, ex *Blarina brevicauda*, 2 ♂, 4 ♀ (C.H.D.C.); VII-VIII.34, ex *Parascalops breweri*, 2 ♂ (C.H.D.C.)
Long Lake, 24.VII.33, ex *Peromyscus* sp., 1 ♀ (C.H.D.C.)
Pancake Bay, Algoma, VIII-IX.35, ex *Blarina brevicauda talpoides*, 5 ♂, 3 ♀ (C.H.D.C.). 31.VII.35, ex *Sorex* sp., 2 ♀ (C.H.D.C.)

Specimens examined: 11 ♂, 13 ♀, including the type ♂ (U. S. N. M.)

CORRODOPSYLLA Wagner

Genotype: *Doratopsylla curvata* Rothschild 1915

Corrodopsylla Wagner 1929, Konowia 8:317. (used as subgenus).

Corrodopsylla Wagner. Wagner 1936, Can. Ent. 68(9):205. (raised to generic status).

General structure very like *Doratopsylla*. Genal process clearly visible above fourth genal spine (Pl. XVI, fig. 111). Abdominal tergum VII produced posteriorly into a pair of processes between the two sets of antepygidial bristles (fig. 112).

Holarctic. Two species recognized in North America. One of these, *C. curvata* (Rothschild) is represented by two subspecies, both of which occur in Canada. True hosts are the long-tailed shrews, *Sorex* spp.

Key to the subspecies of *Corrodopsylla curvata*

1. Found east of the Cascade Mountains.
   ♂. F just equalling P_1 of the clasper (Pl. XVI, fig. 112)
   ♀. Lower margin of sinus of sternum VII with chitinous thickening (fig. 113) . *curvata curvata*

   West of the Cascades only.
   ♂. F exceeding P_1 in length (fig. 114)
   ♀. Sinus and lobe of sternum VII more extensively developed, and without the thickening (fig. 115) . . . . *curvata obtusata*

CORRODOPSYLLA CURVATA CURVATA (Rothschild)

(Plate XVI, figs. 111, 112, 113; Map 13)

Doratopsylla curvata Rothschild 1915, Ectoparasites 1:25-27; text-figs. 28,29. Both sexes from Iowa City, Iowa (type locality) ex *Blarina brevicauda*. Also collected at Blackfalds, Alta, ex "kangaroo mouse" (*Zapus* sp.) and "shrew mouse" (*Sorex* sp.).

Doratopsylla (*Corrodopsylla*) *curvata* Rothschild. Wagner 1929, Konowia 8:317.

Corrodopsylla curvata Rothschild. Wagner 1936, Can. Ent. 68(9):205. Recorded from Kamloops, B. C., ex *Sorex*.

Doratopsylla curvata Rothschild. I. Fox 1940, Fleas of Eastern U. S., pp. 94-95; pl. XXVI, figs. 133,136,138.

Corrodopsylla curvata curvata (Rothschild). Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:81.

This subspecies is apparently widespread in Canada, occurring from central British Columbia to Ontario.

New Canadian records:

B.C.: Osoyoos, 21.VIII.44, ex *Sorex* sp., 1 ♀ (G.P.H.)
Penticton, 14.V.42, ex *Sorex o. obscurus*, 4 ♂, 14 ♀ (G.P.H.)
Sugar Lake, 16.V.42, ex *Sorex o. obscurus*, 3 ♀ (G.P.H.)
Williams Lake, 14.IV.44, ex *Sorex*, 1 ♀ (G.P.H.)

Sask.: Estevan, 23.VII.42, ex *Sorex cinereus haydeni*, 1 ♂, 2 ♀ (G.P.H.)

Ont.: Brule Lake, Algonquin Pk., ex *Blarina brevicauda talpoides*, 2 ♂, 1 ♀ (C.H.D.C.)
Pancake Bay, Algoma, VIII.35, ex *Blarina brevicauda talpoides*, 2 ♂, 1 ♀ (C.H.D.C.); 25.VII.35, ex *Sorex* sp., 1 ♂ (C.H.D.C.)

Specimens examined: 10 ♂, 25 ♀.

CORRODOPSYLLA CURVATA OBTUSATA (Wagner)
(Plate II, fig. 2; plate XVI, figs. 114, 115; Map 13)

Doratopsylla (Corrodopsylla) curvata obtusata Wagner 1929, Konowia 8:318; text-fig. 1. Two females, from Abbotsford, B. C., ex *Sorex* sp.

Corrodopsylla curvata obtusata Wagner. Wagner 1936, Can. Ent. 68(9):205.

Doratopsylla jellisoni Hubbard 1940, Pac. Univ. Bul. 37(2):8,10, figs. p. 9. Types from Forest Grove, Oregon, ex *Sorex trowbridgii*. Many other records from Washington, Oregon and northern California, west of the crest of the Cascade Mountains, ex various *Sorex* spp. and *Microtus* spp. Synonym, fide Holland (1942:157).

Doratopsylla curvata obtusata Wagner. Holland 1942, Can. Ent. 74(9):157. Synonymy with D. *jellisoni* Hubb. noted. New British Columbia records from Silver Creek and Chilliwack, ex *Sorex* spp.; Vancouver, ex nest of *Neurotrichus g. gibbsii;* Huntingdon, ex *Microtus oregoni serpens*.

In Canada, this subspecies is entirely confined to the southern Pacific coastal area of British Columbia, west of the Cascades. The characters, male and female, separating this flea from typical *curvata* are so well defined that the writer feels that it probably would be quite justifiable to regard *obtusata* as a full species.

New Canadian records:

B.C.: Cowichan Lake, V.I., 28.IX.37, ex *Sorex vagrans vancouverensis*, 1 ♂, 1 ♀ (G.C.C.)
Manning Park, 29.VII.45, ex *Sorex* sp., 1 ♀ (G.C.C.)

Specimens examined: 14 ♂, 17 ♀, including two pairs of paratypes of Hubbard's "*Doratopsylla jellisoni*" (U. S. N. M.).

Subfamily E. ANOMIOPSYLLINAE Baker 1905.

Degenerate, showing much reduction in vestiture.

Eye vestigial or totally absent. In two genera, the second joint of the antenna is produced outwards, forming a sheath about the base of the club. No trabecula centralis. Genal ctenidium lacking. Pronotal ctenidium usually present, but lacking in one genus *(Anomiopsyllus)*. No interantennal division of head capsule except in one genus *(Stenistomera)*.

Distinguished from all other Hystrichopsyllidae by the concave upper anterior margin of the metepisternum. The pleural ridge of the metasternum too is characteristic, being long, of even width, and lacking the "ball joint" at its dorsal extremity.

Vestiture of anterior abdomen much reduced, there being only a single row of setae to each tergum, except in *Conorhinopsylla*, which has part of a second row. A few apical spinelets persisting. Antepygidial setae present in both sexes. No spinelets on inside of hind coxa.

Male genitalia sometimes armed with blunt pigmented spinelike setae. Sternum VIII somewhat expanded, and sometimes lobed.

Females with single spermatheca.

A strictly nearctic group, containing five known genera. Of these, only the very degenerate *Anomiopsyllus* and the remarkable *Stenistomera* * are not known as yet from Canada. The Anomiopsyllinae are nest fleas and seldom taken on the host animals.

CALLISTOPSYLLUS Jordan and Rothschild

Genotype: *Ceratophyllus terinus* Rothschild 1905.
Callistopsyllus Jordan and Rothschild 1915. Ectoparasites 1:46.

Clypeal tubercle conspicuous. Labial palpus 4-segmented. Second antennal segment widened on outside, and covering part of the clava (Pl. XVII, fig. 116). Pronotal ctenidium present. First pair of plantar bristles shifted ventrally. Three antepygidial setae in both sexes. Abdominal terga each with but one row of setae. Sternum VIII of males unmodified.

* Good (1942:131-132) erected a special subfamily to contain this genus, but characters of antennae, thorax, abdominal terga and male genitalia indicate a very definite relationship to *Callistopsyllus*, in spite of the peculiarities of the head capsule.

Dorsal apical margin of clasper with single long seta. F with blunt spiniforms.

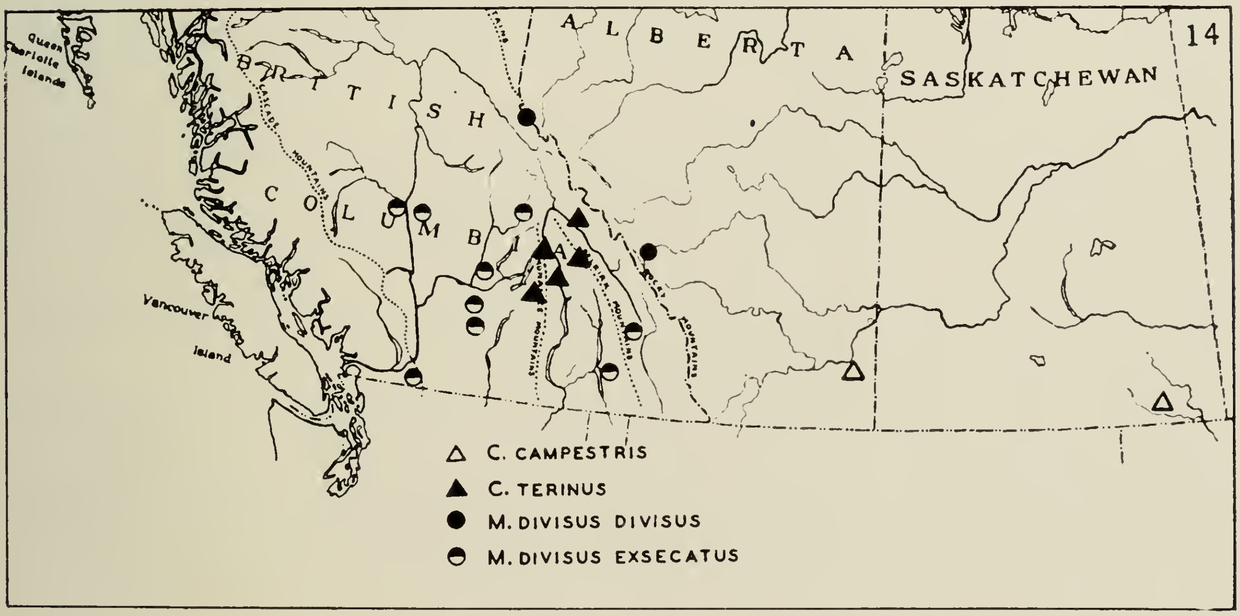
Small fleas, very rare in collections, probably because they are chiefly nest fleas (cf. *Megarthroglossus*) and seldom travel on the host animal. White-footed mice (*Peromyscus* spp.) are apparently the normal hosts.

Three species have been described. One, *C. deuterus* Jordan 1937, from California, is not known in Canada. The remaining two were described from British Columbia, and are regarded as synonymous by the present writer. A new species is described in this paper to accommodate specimens from the Canadian prairie.

Key to the Canadian species of *Callistopsyllus*

1. ♂. F subtriangular, broad at base and narrowed apically (Pl. XVII, fig. 118)
   ♀. Head of spermatheca distinctly shorter than tail (fig. 119) . . . . *terinus*

   ♂. F more oval; broadly rounded apically (fig. 120)
   ♀. Head of spermatheca as long, or slightly longer than tail (fig. 121) . . . . *campestris*, n. sp.



MAP 14

Hystrichopsyllidae:Anomiopsyllinae. Locality records of *Callistopsyllus campestris* n. sp., *C. terinus* (Rothschild), *Megarthroglossus divisus divisus* (Baker) and *M. d. exsecatus* Wagner.

CALLISTOPSYLLUS TERINUS (Rothschild)

(Plate XVII, figs. 116, 117, 118, 119; Map 14)

Ceratophyllus terinus Rothschild 1905, Nov. Zool. 12:158-159; pl. VIII, fig. 26; pl. IX, fig. 29. Described from three females, from Mabel Lake, B. C., ex "*Spermophilus columbianus*" (*Citellus c.*, an accidental host).

Callistopsyllus terinus (Rothschild). Jordan and Rothschild 1915, Ectoparasites 1:46.

Callistopsyllus paraterinus Wagner 1940, Zeitschr. f. Parasitenk. 11(4):465-466; text-figs. 5,6. Described from a single male, from the north Fork of the Eagle River, (Perry River) B. C., ex *Peromyscus maniculatus*. New synonymy.

In Canada, *Callistopsyllus terinus* has been collected only in the Columbia Forest region, or "Interior Wet Belt" of British Columbia. Males and females from Eagle Pass, near Revelstoke show that Wagner's "*paraterinus*" is simply the male of *terinus*. The type localities of the two are only thirty miles apart, in the same biotic area. The record of *terinus* from *Citellus* was obviously a chance occurrence as all other records of these fleas are from *Peromyscus*.

Possibly an examination of mouse nests might yield good series of these fleas. Certainly they are hard to obtain by trapping, and a sample of a hundred or so fleas collected by trapping *Peromyscus* at the very best will have only one or two specimens of *Callistopsyllus*.

New Canadian records:

B.C.: Eagle Pass, 17.V.45, ex *Peromyscus m. artemisiae*, 1♂, 1♀ (G.P.H.); 8.V.46, ex *P. m. artemisiae*, 1♂, 2♀ (G.P.H.)
Glacier, VIII.42, ex *Peromyscus m.* ssp., 2♀ (J.D.G.)
Kinbasket Lake, 27.VIII.42, ex *Peromyscus m.* ssp., 1♀ (J.D.G.); 4.VIII.43, ex *Peromyscus m.* ssp., 1♀ (G.P.H.)

Specimens examined: 5♂, 7♀, including the type of "*C. paraterinus*".

CALLISTOPSYLLUS CAMPESTRIS new species

(Plate XVII, figs. 120, 121; Map 14)

A small series of fleas from the southern Canadian prairie shows sufficiently definite differences in both sexes from *terinus* to be considered distinct. The single female available resembles *deuterus* from California (the type of this species has been available for comparison, kindness of W. L. Jellison) but in view of the great geographical disparity it appears warrantable to regard the Canadian form as distinct for the present. The description and illustration of the male of *deuterus* (Augustson, 1941:140-141; pl. XVI, fig. 3) are not sufficiently detailed, demonstrating no characters whereby it could be distinguished from *terinus*. A male, labeled *deuterus*, from Arizona, loaned by F. M. Prince is close to males of *terinus* from B. C., and quite distinct from our two males from Alberta and Saskatchewan.

Male. General structure and chaetotaxy essentially as in *C. terinus*, differing only in the modified segments. Moveable process in *terinus* is broad at the base and rather narrowly rounded apically, being roughly triangular in outline (fig. 118). In *C. campestris* it is narrower at the base and more broadly rounded apically, the sides being more or less parallel (fig. 120). The ventral arm of sternum IX is slightly broader, and bears more ventral apical setae in the new species.

Female. Head and tail of spermatheca of nearly equal length (20:19) whereas in our seven females of *terinus*, the head is distinctly shorter (average 16.7:20.5). Also, by the same scale of measurements, the sclerified duct leading to the bursa copulatrix is slightly longer in the new species, being 20 units, whereas *terinus* averages 15.5 units.

Holotype male and *allotype* female from Medicine Hat, Alta., 6.VI.40, ex *Peromyscus maniculatus osgoodi* (type locality and host), collected by G. P. Holland, No. 5718 in the Canadian National Collection, Ottawa.

One male *paratype*, from Estevan, Saskatchewan, 28.VI.42, ex *Peromyscus m. osgoodi*, collected by G. P. Holland, is in the collection of the Livestock Insects Laboratory, Kamloops.

A male from Old Faithful Lodge, Yellowstone National Park, Wyoming, 22.V.40, ex *Peromyscus maniculatus*, loaned by Dr. N. E. Good, is of this species.

MEGARTHROGLOSSUS Jordan and Rothschild

Genotype: *Megarthroglossus procus* Jordan and Rothschild 1915.
Megarthroglossus Jordan and Rothschild 1915, Ectoparasites 1:46.

Clypeal tubercle present, small. Eye represented by distinct vestige. Labial palpus of five segments, the last one being very long (fig. 122). Second antennal segment not sheathing base of clava. Pronotal ctenidium present. Five pairs of plantar bristles on all tarsi V, the proximal pair displaced ventrally. Abdominal terga each with but one row of setae.

Males without pigmented spiniforms on the genitalia. Sternum VIII slightly more expanded than in *Callistopsyllus*.

Spermatheca of females frequently with a characteristic "collar" on the head.

Small, weak, blind fleas, confined chiefly to the nests of their hosts, which are usually woodrats *(Neotoma)* or red squirrels, *(Tamiasciurus)*.

The genus is apparently confined to western North America. Eight species and subspecies have been described. All but one of these occur in Canada. Some of the species are very much alike; several of the forms were described from one sex only, and sometimes from only a single specimen. The writer feels that when larger collections are available, some of the species described by Wagner in 1936 may be relegated to synonymy.

Keys to the Canadian species and subspecies of *Megarthroglossus*

Males.

Note: the male of *M. spenceri* is not known. It may readily be, however, that this species is synonymous with *M. pygmaeus*; see discussion of this, p. 101.

1. Posterior margin of sternum VIII sinuate 2
   Posterior margin of sternum VIII convex, not sinuate (fig. 131) .... *sicamus*
2. Lower margin of clasper distinctly indented at base of manubrium (fig. 125) 3
   Lower margin only very slightly indented, if at all 4
3. Ventral margin of ventral arm of sternum IX bent sharply dorsad, posterior to the marginal row of setae (fig. 125) .... *similis*
   Ventral margin not bent so sharply (fig. 123) .... *procus*
4. F with an angular prominence on the anterior margin, one third way down from the apex. Sternum VIII shallowly sinuate (fig. 130) .... *pygmaeus*
   F without such angular prominence. Sternum VIII more deeply sinuate (fig. 126) .... *divisus* ssp. 5
5. Clasper (including manubrium) twice as long as high (fig. 126) .... *divisus divisus*
   Clasper less than twice as long as high.
   Apex of manubrium turned upwards more sharply (fig. 128) .... *divisus exsecatus*

Females.

Note: the females of *M. pygmaeus* and *M. similis* are not known.

1. Spermatheca with distinct "collar" 2
   Spermatheca bulged dorsally, but without "collar" (fig. 124) .... *procus*
2. Sternum VII with lobe and sinus 3
   Sternum VII irregular, but without distinct lobe and sinus 4
3. Rocky Mountains and eastward. Sinus in sternum VII relatively small (fig. 127) *divisus divisus*
   West of Rocky Mountains. Sternum VII more deeply incised (fig. 129 a-c) .. *divisus exsecatus*
4. Collar of spermatheca large and globular (fig. 133) .... *spenceri*
   Collar of spermatheca reduced (fig. 132) .... *sicamus*

MEGARTHROGLOSSUS DIVISUS DIVISUS (Baker)

(Plate XVIII, figs. 126, 127; Map 14)

Pulex longispinus Baker 1895, Can. Ent. 27:131-132. Described (no details of sexes) from Georgetown, Colorado, ex "Fremont's chickaree" (*Tamiasciurus fremonti* ssp.).

Pulex divisus Baker 1898, Journ. N. Y. Ent. Soc. 6:54. New name for *P. longispinus* Baker 1895, preoccupied by *P. longispinus* Wagner 1893.

Ceratophyllus divisus (Baker). Baker 1904, U. S. Nat. Mus. Proc. 27:388,416,441; pl. XXI, figs. 7-10.

Megarthroglossus longispinus (Baker). Jordan and Rothschild 1915, Ectoparasites 1:52-53; text-figs. 55,56. Re-description of the species, with detailed illustrations. Recorded from Red Deer River, Alta, ex "*Sciurus richardsonii*" (*Tamiasciurus hudsonicus r.*) and "*Mus* sp." (*Peromyscus? Microtus?*).

Sternum VIII of the males is divided by a sinus into two broadly rounded lobes.

Sternum VII of the female has a small lobe and sinus (fig. 127). The head of the spermatheca bears a pronounced collar.

In Canada, this subspecies is probably confined to the Rocky Mountain region and eastward—see discussion under *M. d. exsecatus*.

New Canadian records:

B.C.: Berg Lake, Mt. Robson Park, 28.VII.44, ex *Neotoma cinerea drummondi*, 4 ♂, 4 ♀ (G.P.H.). 28.VII.44, ex *Microtus longicaudus mordax*, 1 ♀ (G.P.H.)

Specimens examined: 6 ♂, 8 ♀, including the type ♀ (U. S. N. M.)

MEGARTHROGLOSSUS DIVISUS EXSECATUS Wagner

(Plate XVIII, figs. 128, 129; Map 14)

Megarthroglossus longispinus var. *exsecatus* Wagner 1936, Can. Ent. 68(9):196. A single female from Avola, B. C., ex "*Sciurus douglassi*" (err. det., the local species is *Tamiasciurus hudsonicus streatori*).

Megarthroglossus divisus (—*longispinus*) var. *exsecatus* Wagner. Holland 1941, Ent. Soc. B. C. Proc. 37:11. Recorded from Vavenby and Nicola, ex *Tamiasciurus h. streatori*, and a large series from Rayleigh ex nest of *T. h. streatori*.

Megarthroglossus divisus exsecatus Wagner. Jellison and Good 1942, Nat. Inst. Hlth. Bul. 178:83.

A large number of these fleas, from various localities in the Interior of British Columbia indicates that the enlarged sinus in sternum VII is a reasonably constant character whereby this subspecies may be distinguished from *M. d. divisus*. The Continental Divide (Rockies) probably separates the races of

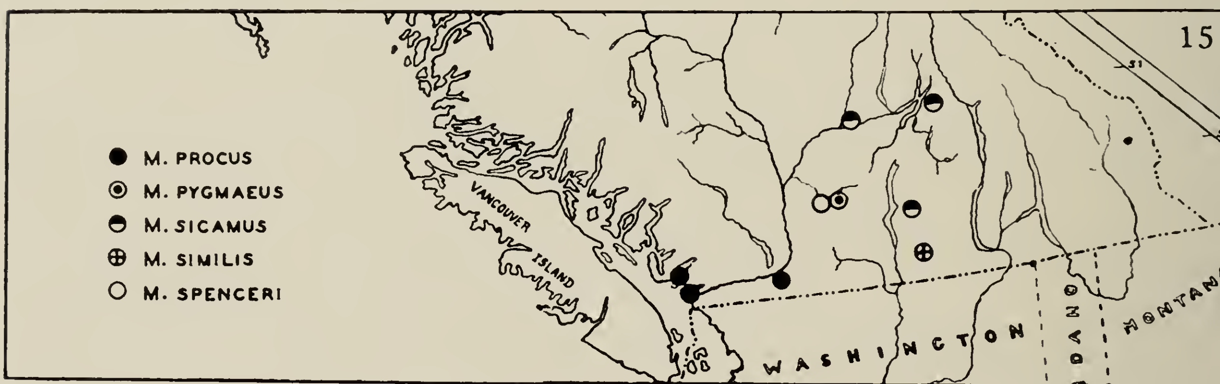
M. divisus, the type subspecies occurring to the east, and *M. d. exsecatus* to the west. There is difference of opinion as to whether *Neotoma* or *Tamiasciurus* is the true host of these fleas. The male of *exsecatus* has not previously been described or illustrated.

Male. Like *M. d. divisus*, but with the claspers somewhat shorter and with the apex of the manubrium turning upwards slightly. The ventral arm of sternum IX is broadly rounded apically, showing no tendency to become narrowed on the ventral margin, immediately distad to the ventral marginal row of setae (cf. figs. 128 and 126).

New Canadian records:

B.C.: Cultus Lake, 12.II.41, ex "weasel", 1♂ (D.L.)
Ewing's Landing, 18.X.46, ex nest of *Tamiasciurus h. streatori*, 3♂ (W.H.)
Grey Creek, III.40, ex "weasel", 1♂, 1♀ (G.O.)
Kinbasket Lake, 4.VIII.43, ex *Tamiasciurus hudsonicus* ssp., 1♂ (G.P.H.)
Lac la Hache, 12.X.46, ex nest of *T. hudsonicus columbiensis*, 1♂, 4♀ (G.P.H.)
Manning Park, VIII.45, ex *Peromyscus maniculatus* ssp., 1♂ (G.C.C.)
Paradise Mine, 31.VIII.44, ex *Glaucomys sabrinus fulginosus*, 1♀ (G.C.C.)
Springhouse, 11.X.46, ex nest of *T. hudsonicus* ssp., 1♂, 1♀ (G.P.H.)
Terrace Mt., 18.X.46, ex T. *hudsonicus streatori*, 1♀ (J.D.G.)

Specimens examined: large series, including the holotype and an additional female from Nicola, determined by Wagner.



MAP 15

Hystrichopsyllidae:Anomiopsyllinae. Locality records of *Megarthroglossus procus* Jordan and Rothschild, *M .pygmaeus* Wagner, *M. sicamus* Jordan and Rothschild, *M. similis* Wagner and *M. spenceri* Wagner.

MEGARTHROGLOSSUS PROCUS Jordan and Rothschild

(Plate XVII, figs. 122, 123; plate XVIII, fig. 124; Map 15)

Megarthroglossus procus Jordan and Rothschild 1915, Ectoparasites 1:47-50; text-figs. 50-52. Both sexes, from Chilliwack, B. C., ex "*Spilogale*" (*S. gracilis olympica*).

This species is readily distinguished from other members of the genus by the character of the claspers in the male, and the spermatheca and sternum VII in the female.

In Canada, it is probably confined to the Pacific coast lowlands, west of the Cascades. Hubbard (1943) lists it from Oregon and California.

New Canadian records:

B.C.: Gambier Island, 21.II.43, ex *Tamiasciurus douglassi mollipilosus*, 1♂ (I.McT.C.)
Vancouver, 7.I.45, ex *Rattus norvegicus*, 1♀ (F.L.B.)

Specimens examined: 1♂, 1♀.

MEGARTHROGLOSSUS PYGMAEUS Wagner

(Plate XVIII, fig. 130; Map 15)

Megarthroglossus pygmaeus Wagner 1936, Can. Ent. 68(9):196-197; pl. II, fig. 4. A single male, from Nicola, B. C., ex *Neotoma cinerea* ssp. (*occidentalis*).

This species is close to *M. divisus*, from which it may be distinguished by the shape of the moveable processes of the claspers, and the posterior arm of sternum IX. The single specimen available is extremely small (1.3 mm.).

See notes under *M. spenceri* for discussion of probable synonymy with this species.

There are no new records.

Specimens examined: 1 ♂ (the holotype).

MEGARTHROGLOSSUS SICAMUS Jordan and Rothschild

(Plate XVIII, figs. 131, 132; Map 15)

Megarthroglossus sicamus Jordan and Rothschild 1915, Ectoparasites 1:50-52; text-figs. 49,53,54. Both sexes, from Eagle River, Sicamous, B. C., ex *Canis latrans* (likely a transitory host).

Megarthroglossus sicamus Jordan and Rothschild. Wagner 1936, Can. Ent. 68(9):196. Recorded from Rutland, B. C., (6000') ex *Neotoma cinerea occidentalis.*

This species so far has been collected only in British Columbia. It is readily recognizable in both sexes. The males have sternum VIII broadly rounded, without a sinus (fig. 131). The females have a very characteristic spermatheca.

New Canadian record:

B.C.: Kamloops, 20.XI.46, ex bob-cat (*Lynx* sp.) 1 ♀ (N.M.C.)

Specimens examined: 2 ♀. Figure of ♂ after Jordan and Rothschild.

MEGARTHROGLOSSUS SIMILIS Wagner

(Plate XVIII, fig. 125; Map 15)

Megarthroglossus similis Wagner 1936, Can. Ent. 68(9):196; pl. II, fig. 1. Described from two males, collected at Beaverdell, B. C., ex *Neotoma cinerea occidentalis.*

Megarthroglossus senisles (sic!) Wagner. Spencer 1936, Ent. Soc. B. C. Proc. 32:14.

According to Wagner, this species occupies a position between *M. procus* and *M. longispinus (divisus).* The apex of the ventral arm of sternum IX is distinctly bent upwards (fig. 125).

We have no new records, and the female remains unknown.

Specimens examined: none. Figure after Wagner.

MEGARTHROGLOSSUS SPENCERI Wagner

(Plate XVIII, fig. 133; Map 15)

Megarthroglossus spenceri Wagner 1936, Can. Ent. 68(9):196; pl. II, figs. 2,3. Described from a single female, from Nicola, B. C., ex *Ochotona princeps.*

The collar on the spermatheca is more globular than that of *divisus*, and sternite VII has a rounded apical angle, but no sinus (fig. 133).

The present writer feels that *M. spenceri* and *M. pygmaeus* are probably synonymous. Both are from Nicola, B.C., one from a pika and one from a woodrat. The writer is familiar with the type locality and knows that both these animals occur in a certain rockslide there. Under these circumstances he does not feel that too much stress should be laid on host difference. Other woodrat fleas (e.g. *Orchopeas 6-dentatus agilis*) are frequently taken on pikas. If the species do prove to be synonymous, the name *spenceri* should hold, having line priority.

We have no new records.

CONORHINOPSYLLA Stewart

Genotype: *Conorhinopsylla stanfordi* Stewart 1930

Conorhinopsylla Stewart 1930, Can. Ent. 62:178.

Conorhinopsylla Stewart. I. Fox 1940, Fleas of Eastern U. S., p. 41.

Conorhinopsylla Stewart. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:73-74.

Frons very gently rounded, without tubercle. Eyes vestigial. Genal lobe rounded (Pl. XIX, fig. 134). Labial palpus long, with 5-8 or more segments. Antennae long, in males extending beyond posterior border of the pleurosternal plate. Pedicel not enclosing clava. No trabecula centralis, or rod-like tentorial arms in genal region. Pronotal ctenidium of 12-14 large black spines. Long hair-like setae on tarsal segments I and II of hind leg. Five pairs of plantar bristles on all tarsi V, the first pairs of which are shifted ventrally. Abdominal

terga each with two rows of setae, of which the first row is much reduced. Male with one large antepygidial bristle and two minute ones. Female with three well developed bristles.

Body of clasper of male elongated. Sternum IX curved rather than sharply angulate at the junction of dorsal and ventral arms. Sternum VIII with apical spinelets, setae and small membrane (fig. 135).

Strictly nearctic. Two species known: one, the genotype, parasitic on squirrels; the other (*C. nidicola* Jellison 1945) on *Neotoma*.

One species, the genotype, is known from Canada.

CONORHINOPSYLLA STANFORDI Stewart

(Plate XIX, figs. 134, 135, 136; Map 12)

Conorhinopsylla stanfordi Stewart 1930, Can. Ent. 62:178-179; pl. 15, figs. 3-5. Both sexes, from Ithaca, New York, ex "*Sciurus hudsonicus*" (*Temiasciurus h.*).

Conorhinopsylla stanfordi Stewart. Jordan 1937, Nov. Zool. 40:267-268; text-figs. 51,52,53.

Conorhinopsylla stanfordi Stewart. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:74; fig. 4,C.

Conorhinopsylla stanfordi Stewart. Jellison 1945, Kans. Ent. Soc. Journ. 18(3):109-110.

This interesting flea appears to be confined to eastern North America, where tree squirrels *(Sciurus, Tamiasciurus* and *Glaucomys)* are apparently the true hosts. It is probably a nest flea.

Following is the first Canadian record, from the files of Dr. M. A. Stewart.

New Canadian record:

Ont.: Kerwood, 22.XI.21, ex "flying squirrel" (*Glaucomys volans volans*) (L.L.S.)

Specimens examined: None from Canada.

1 ♂, 1 ♀ from Michigan, ex *Glaucomys*, received from Dr. Wm. L. Jellison.

SUBFAMILY F. NEARCTOPSYLLINAE, NEW SUBFAMILY.

The genus *Nearctopsylla* Rothschild 1915 and its allies, *Corypsylla* Fox 1908 and *Corypsylloides* Hubbard 1940 form a small natural group rather remote from other Hystrichopsyllidae. In the past they have been associated with various subfamilies, including *Hypsophthalminae* by Wagner (1939) and *Leptopsyllinae* by Jellison and Good (1943) and Ewing and Fox (1944), but as Dr. Karl Jordan pointed out to the writer they are not closely akin to other genera allocated to these groups, and are best placed by themselves.

Eye vestige high up on head, above genal ctenidium (this character occurs also in certain Old World fleas). "Clypeal" tubercle present or absent. Genal ctenidium of characteristic spatulate spines arranged vertically. Pre- and postantennal regions of head divided by a suture above the antennal fossae.

Pronotum with ctenidium. Cervical sclerites long. No pleural ridge on pleurosternal plate. Metanotum of *Corypsylloides* and *Nearctopsylla brooksi* unique among North American Hystrichopsyllids in having a few pseudosetae located under the flange as on the mesonotum. All other species without pseudosetae or spinelets on the metanotum. Upper margin of metasternum (episternum) very broadly rounded (figs. 137, 141).

Row of spinelets on inside of hind coxa, but no striarium visible on thorax or abdomen. Anterior abdominal terga without major combs, but with apical spinelets. Antepygidial setae present. Females with single spermatheca.

Abdominal segment VIII of males not greatly modified, the tergum only slightly reduced and the sternum slightly expanded. Clasper plates broad and rounded. Genital armature without pigmented spiniforms.

Contains only the nearctic genera *Nearctopsylla*, *Corypsylla* and *Corypsylloides* (this last not yet known from Canada), all of which are associated with the mammal order Insectivora. Most Nearctopsyllinae are restricted to western North America.

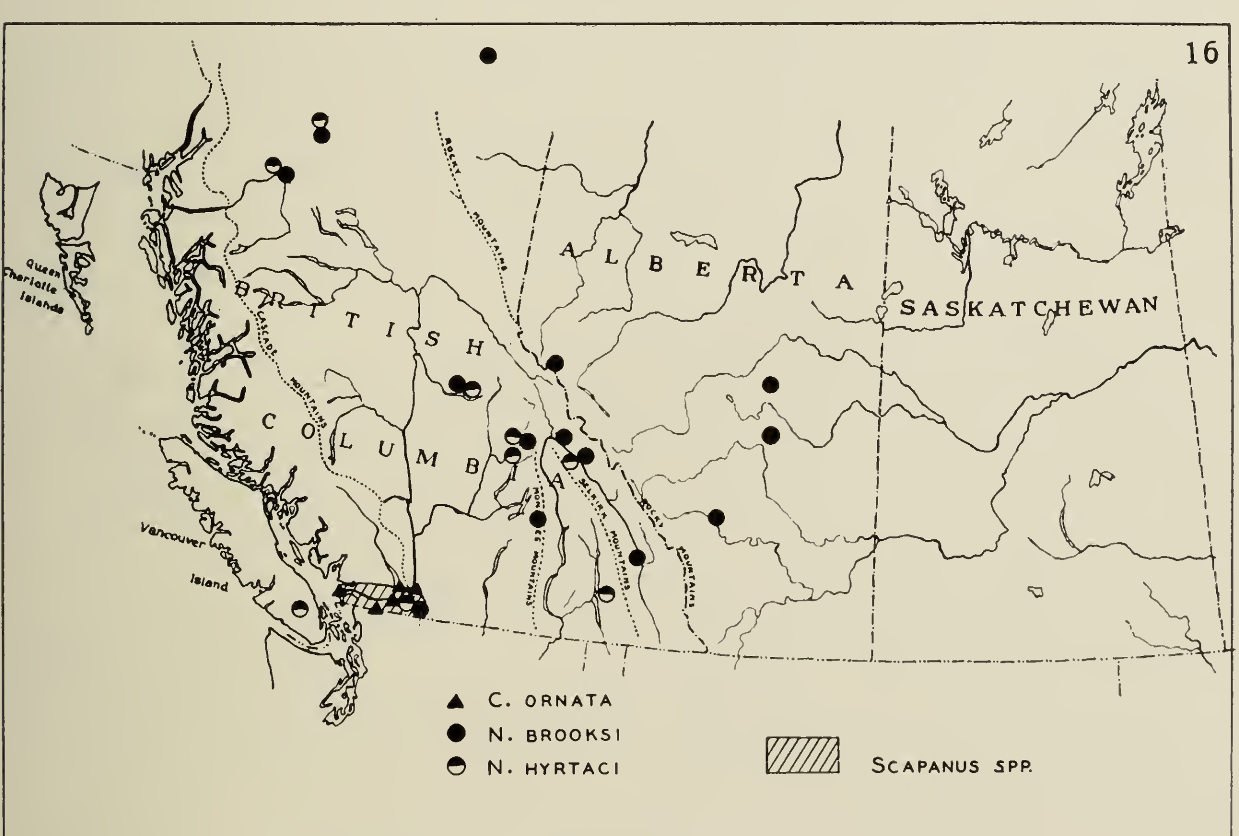
CORYPSYLLA C. Fox

Genotype: *Corypsylla ornatus* C. Fox 1908
Corypsylla. C. Fox 1908, Ent. News 19:452-455.
Corypsylla C. Fox. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:95.

Head rounded in front and bearing a tubercle in the one Canadian species (Pl. XIX, fig. 137). Genal ctenidium of six spatulate unequal spines. Vestige of eye high up on head, above uppermost genal spine. In the females, some of the ventral spines of the pronotal ctenidium are pale and partly fused together. Meso- and metanota and abdominal terga I-VI with heavy dorsal incrassations. Terga I-VI with incrassations particularly deep, and with a few dorsal apical spinelets. Males with incrassations on terga VII and VIII also. No pleural ridge in mesothorax. Four pairs of lateral plantar bristles on all tarsi V. Typical abdominal terga each with one row of setae.

Males with tergite VIII somewhat reduced; sternite VIII virtually unmodified.

The genus, which is nearctic, is represented by three species, one of which is recorded from British Columbia. These fleas are normal parasites of Pacific coast moles, *Scapanus* and *Neürotrichus.*



MAP 16

Hystrichopsyllidae:Nearctopsyllinae. Locality records of *Corypsylla ornata* Fox (superimposed on range of western moles, *Scapanus* spp. after Jackson 1915), *Nearctopsylla brooksi* (Rothschild) and *N. hyrtaci* (Rothschild).

CORYPSYLLA ORNATA C. Fox

(Plate XIX, figs. 137, 138, 139; Map 16)

Corypsylla ornatus C. Fox 1908, Ent. News 19:452-455. Both sexes from San Francisco, California, ex "*Scapanus californicus*" (*S. latimanus*).

Corypsylla ornatus Fox. Wagner 1940, Zeitsch. f. Parasitenk. 11(4):463. Recorded from University of British Columbia campus, Vancouver, ex *Scapanus orarius schefferi.*

Corypsylla ornatus Fox. Hubbard 1940, Pac. Univ. Bul. 37(1):7-8; figs.

Corypsylla ornata Fox. Holland 1941, Ent. Soc. B. C. Proc. 37:13. Recorded from Vancouver and Agassiz, B. C. ex *Scapanus orarius schefferi.*

The distribution of this interesting flea, in Canada, is limited to extreme southwest British Columbia, where it occurs on moles, or animals in association with moles.

New Canadian records:

B.C.: Chilliwack, IV-V.44, ex *Scapanus orarius schefferi*, 4♂, 8♀ (H.G.F..); 3.I.40, ex *Scapanus townsendii*, 1♀ (H.G.F.)

Huntingdon, 14.III.43, ex *Microtus t. townsendii*, 1♀ (I.McT.C.)

Vancouver, 29.I.44, ex *Microtus oregoni serpens*, 1♀, (H.D.F.)

Specimens examined: 32♂, 60♀, including the type ♂ and ♀ (U. S. N. M.)

NEARCTOPSYLLA Rothschild

Genotype: *Ctenopsyllus brooksi* Rothschild 1904

Nearctopsylla Rothschild 1915, Nov. Zool. 22:307.

Nearctopsylla Rothschild. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:93-94.

Close to *Corypsylla*, but genal ctenidium of five spatulate spines (Pl. XIX, fig. 140). No clypeal tubercle. No fusion among pronotal spines. No dorsal incrassations on abdominal terga (fig. 142). Two rows of setae on each abdominal tergum.

A nearctic genus, represented by four species, all of which occur in Canada. One species is considered to occur as two or three recognizable subspecies. Typical hosts seem to be various genera and species of Insectivora, although there are two species which seem to be regular winter parasites of Mustelidae in Western Canada. These interesting fleas are comparatively rare in collections.

Keys to the species and subspecies of *Nearctopsylla*

Males.

1. Pronotal comb of 24 or more spines per side. Metanotum with pseudosetae (fig. 141). Posterior half of ventral arm of sternum IX bent dorsally at right angles, and with a thick fringe of setae on its posterior margin (fig. 143) .... *brooksi*
   Pronotal comb of less than 20 spines per side. Metanotum without pseudosetae. Ventral arm of sternum IX not bent at right angles 2
2. Terminal portion of ventral arm of sternum IX bent upwards slightly, and somewhat sharply pointed 3
   Whole of ventral arm curving upwards gradually, and cut off obliquely at apex (fig. 145) *hyrtaci*
3. Known from the southwest corner of British Columbia only. Ventral arm of sternum IX slender apically (fig. 153) .... *jordani*
   Known from the Great Plains region (limits of range unknown). F. proportionately wider than in *jordani*, and ventral arm of sternum IX much broader (fig. 148) ..... *genalis hygini*
   Known from Ontario and the Maritimes, etc. (limits of range unknown). Anterior margin of F less incurved than in *g. hygini;* ventral arm of sternum IX narrower, and with fewer marginal setae (figs. 150, 151) .... *genalis laurentina*

Females.

1. Head of spermatheca more or less globular, showing slight chitinous thickenings, and with a slight constriction at the point where it joins the tail 2
   Head of spermatheca not so well differentiated, and merging more or less imperceptibly with the tail 3
2. Pronotal comb of 18-20 spines per side. Tail of spermatheca about 3 times as long as head (fig. 144) .... *brooksi*
   Pronotal comb of 12-14 spines per side. Tail about twice as long as head (fig. 146) ..... *hyrtaci*
3. (See distribution in key to males)
   Sternum VII with sharply pointed lobe (fig. 154) .... *jordani*
   Sternum VII with rounded lobe and shallow sinus (fig. 149) .... *genalis hygini*
   Sternum VII with rounded lobe and deeper sinus (fig. 152) .... *genalis laurentina*

NEARCTOPSYLLA BROOKSI (Rothschild)

(Plate XIX, figs. 140, 141, plate XX, figs. 143, 144; Map 16)

Ctenopsyllus brooksi Rothschild 1904, Nov. Zool. 11:649-650; pl. XV, figs. 86, 88; pl. XVI, fig. 89. Both sexes from Calgary, Alta (type locality), ex "*Putorius richardsoni*" (*Mustela erminea richardsonii*) and "*Putorius longicaudatus*" (*Mustela frenata longicauda*). Also taken at "Neresall", B. C. (?—not in Gazeteer of B. C.) ex "*Putorius richardsoni*" (*Mustela erminea r.*) and Mabel Lake, British Columbia, ex "*Mustela americana*". (*Martes amesicana* ssp.).

Nearctopsylla brooksi (Rothschild). Rothschild 1915, Nov. Zool. 22:307.

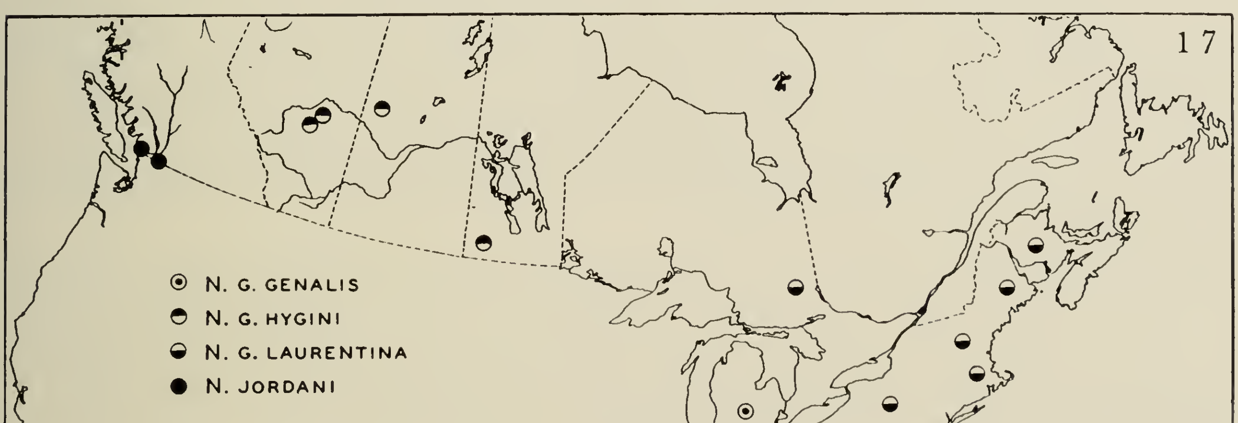
N. brooksi is the largest and most spectacular species of the genus, and is at present known only from British Columbia, western Alberta and Montana. While shrews are the hosts of most *Nearctopsyllae*, *N. brooksi* has only been recorded from Mustelidae, and it is possible that these small carnivores are the true hosts. Nearly all the specimens in the Kamloops collection have been taken during the winter months from marten and weasel by various fur trappers.

New Canadian records:

B.C.: Beavermouth, II.41, ex *Mustela* sp., 2♂, 1♀ (P.B.); ex *Martes americana* ssp., 4♂, 6♀ (P.B.)
Cultus Lake, XI.40, ex *Mustela* sp. 4♀. 23.I.41, 1♀; (D.L.) 22.I.41, ex *Martes americana* ssp., 1♂, 2♀ (D.L.)
Driftwood Valley (Takla Ldg.), 3.VI.38, ex *Mustela erminea richardsonii*, 2♀ (J.F.S.F.)
Fort Nelson (100 miles N. of), 2.IX.43, ex weasel, 1♂, 1♀ (A.L.R.)
Hazelton, 2.VI.38, ex *Mustela erminea richardsonii*, 1♂, 2♀ (J.F.S.F.)
Kinbasket Lake, 14.VIII.44, ex *Mustela erminea* ssp., 1♂ (A.C.B.)
Lempriere, XI.44, ex weasel, 6♀ (O.F.); XI.44, ex *Mustela vison*, 4♀ (O.F.)
Paradise Mine, 26.VIII.44, ex *Mustela frenata oribasa*, 1♂, 4♀ (G.P.H.)
Quesnel Lake, XII.44, ex *Mustela americana*, 2♀ (E.S.K.); XII.44, ex weasel, 4♀ (E.S.K.); XII.44, ex *Mustela vison*, 3♀ (E.S.K.)

Alta.: Bashaw, 20.XI.34, ex "*Mustela a. arctica*", 1♂, 1♀ (G.L.C.)
Edmonton, 21.V.43, ex weasel, 1♂ (J.F.J.)
Jasper National Park, 11.VI.45, ex *Mustela frenata* ssp., 11♂, 19♀ (J.H.)

Specimens examined: 22♂, 62♀.



MAP 17

Hystrichopsyllidae:Nearctopsyllinae. Locality records of *Nearctopsylla genalis genalis* (Baker), *N. g. hygini* (Rothschild), *N. g. laurentina* Jordan and Rothschild and *N. jordani* Hubbard.

NEARCTOPSYLLA GENALIS HYGINI (Rothschild)

(Plate XX, figs. 148, 149; Map 17)

Ctenopsyllus hygini Rothschild 1904 (Sept.). Nov. Zool. 11:650-651; pl. XV, fig. 85; pl. XVI, figs. 93, 94. Both sexes from Red Dear, Alberta, ex "*Putorius richardsoni*" (*Mustela erminea richardsonii*).

Nearctopsylla hygini hygini (Rothschild). Jordan and Rothschild 1923, Ectoparasites 1:315-316; text-figs. 320, 322.

Fox (1940:91) reduced *Ctenopsyllus hygini* Rothschild, Sept. 1904 to synonymy with *Ctenophthalmus genalis* Baker, Feb. 1904, but did not take into consideration, or at least did not mention, the fact that two well-defined subspecies of "*hygini*" are known. Ewing and Fox (1943:94) recognize *Nearctopsylla genalis laurentina* as restricted to New Brunswick, and apparently

regard as true *genalis* all other fleas in this group occurring from Alberta to Minnesota, Iowa, Michigan, Massachussetts and New Hampshire.

The two races of *hygini* were very clearly explained and illustrated in Jordan and Rothschild's paper of 1923, *N. hygini hygini* being listed from Red Deer, Alta., and *N. h. laurentina* from New Brunswick. Good characters, distinguishing both sexes were given. On the basis of a study of specimens in the Kamloops collection, including some from the eastern United States, borrowed from Major Robert Traub, the writer has for some time been of the opinion that Fox was in error in his declaration of synonymy, and that one of the following alternatives will ultimately prove to be true.

Either (1) it is the race *laurentina* that should be considered a synonym of Baker's *genalis*, or (2) *genalis*, *hygini* and *laurentina* should be recognized as three distinct subspecies of *Nearctopsylla genalis*. In any case, *hygini* is quite different from true *genalis*.

N. genalis was described from a single male from Agricultural College (Lansing) Michigan. Fox illustrated this in 1940, but not in sufficient detail. Major Traub was kind enough to prepare for the writer accurate sketches of the moveable process F and the ventral arm of sternum IX of the type at the United States National Museum. These are reproduced herewith (fig. 147) and shown alongside figures of *hygini* (from Saskatchewan, Canada) and *laurentina* (from New Brunswick) for comparison. It will be seen that while differing in small details, *genalis* corresponds more closely with *laurentina*, which is distinguished from *hygini* (as stated by Jordan and Rothschild) by the straighter anterior margin of F, and the shape of sternum IX, which is distinctly narrower, and with fewer marginal setae.

Fox's figure of the female of *genalis* too corresponds more closely with the characters illustrated by Jordan and Rothschild for the eastern race *laurentina*.

On the basis of the above data, the writer feels that at present it would be best to allow these fleas to be considered as three subspecies, of which two, *N. genalis hygini* and *N. genalis laurentina*, occur in Canada. Map 17 shows the distribution of these fleas in North America so far as our records indicate.

N. jordani (which see) from the Pacific coast is also a close relative. In fact, Wagner (1940:467) in the description of a synonym of this flea, considered it as a western subspecies of "*N. hygini*".

New Canadian records:

Alta.: Bashaw, 20.XI.34, ex "*Mustela a. arctica*", 1 ♀ (G.L.C.)
Sask.: Pierce Lake, nr. Meadow Lake, 7.XI.46, ex "*Sorex* sp. (*arcticus?*)", 4 ♂, 5 ♀ (W.F.)
Man.: Aweme, II.15, ex *Mustela erminea* ssp., 5 ♀ (S.C.) (labeled as '*Leptopsylla hygini*", by N. C. Rothschild).

Specimens examined: 4 ♂, 11 ♀ (figure of female after Jordan and Rothschild, 1923).

NEARCTOPSYLLA GENALIS LAURENTINA Jordan and Rothschild

(Plate XX, figs. 150, 151, 152; Map 17)

Nearctopsylla hygini laurentina Jordan and Rothschild 1923, Ectoparasites 1:315-316; text-figs. 319, 321. Both sexes, from New Brunswick (no specific locality), ex *Mustela* sp.

Nearctopsylla genalis laurentina Jordan and Rothschild. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500-94.

The writer has examined specimens he considers to be of this subspecies (or true *genalis?*) from the following localities in the United States: Ithaca, N.Y., 1 ♂; West Springfield, Mass., 1 ♂, 2 ♀; Lincoln, Maine, 1 ♀ and Mendon, Vt., 2 ♀.

New Canadian records:

Ont.: Charlton, 18.XII.34, ex *Mustela erminea* ssp., 1 ♂, 1 ♀ (E.D.)
N.B.: Scotch Lake, 18.XII.31, ex weasel, 1 ♂ (W.H.M.)

Specimens examined: 4 ♂, 6 ♀.

NEARCTOPSYLLA HYRTACI (Rothschild)
(Plate XIX, fig. 142; plate XX, figs. 145, 146; Map 16)

Ctenopsyllus hyrtaci Rothschild 1904, Nov. Zool. 11:652; pl. XVI, figs. 92,95. Male from "Cariboo" (a district, not a specific locality) British Columbia, ex "*Putorius energumenos*" (*Mustela vison energumenos*) and both sexes ex *Sorex obscurus*, British Columbia, no exact locality.

Nearctopsylla hyrtaci (Rothschild.) Rothschild 1915, Nov. Zool. 22:307.

This rare flea is at present known only from British Columbia. While usually taken on Mustelidae, it has occasionally been collected on *Sorex*. It is usually collected in company with *N. brooksi*.

New Canadian records:

B.C.: Beavermouth, 2.II.41, ex *Mustela* sp., 3 ♀ (P.B.)
Cowichan Lake, Vancouver Island, 22.II.41, ex *Martes caurina vancouverensis*, 1 ♀ (J.H.)
Cultus Lake, 22.I.41, ex *Martes americana* ssp., 1 ♀ (D.L.); 23.I.41, ex *Mustela* sp. 1♂ (D.L.). 12.II.41, 1 ♀
Driftwood River, II.38, ex *Clethrionomys gapperi saturatus*, 1♂ (J.F.S.F.)
Grey Creek, III.40, ex *Mustela* sp., 1 ♀ (G.O.)
Hazelton, 21.XII.37, ex *Sorex cinereus*, 1 ♀ (J.F.S.F.)
Lempriere, XI.44, ex *Mustela* sp., 3 ♀ (O.F.)
Quesnel Lake, XII.44, ex weasel, 2 ♀ (E.S.K.); XII.44, ex *Mustela vison* ssp., 1♂ (E.S.K.); XII.44, ex *Martes americana* ssp., 1 ♀ (E.S.K.)
Vavenby, 16.VI.40, ex *Mustela frenata* ssp., 1♂ (J.D.G.)

Specimens examined: 3♂, 23 ♀.

NEARCTOPSYLLA JORDANI Hubbard
(Plate XX, figs. 153, 154; Map 17)

Nearctopsylla jordani Hubbard 1940 (April), Pac. Univ. Bul. 37(1):3-4; figs. Both sexes, from Forest Grove and Cannon Beach, Oregon, ex *Scapanus townsendii*.

Nearctopsylla hygini columbiana Wagner 1940 (May), Zeitschr. f. Parasitenk. 11(4):467; fig. 7. Male, from Vancouver, B. C., ex *Scapanus orarius schefferi*. Synonym, fide Holland (1942:158).

See note on this flea under *Nearctopsylla genalis hygini*. *N. jordani* appears to be confined in distribution to the Pacific coast lowlands, where it normally occurs on *Neürotrichus* and *Scapanus*.

New Canadian records:

B.C.: Huntingdon, 14.III.43, ex *Neürotrichus g. gibbsii*, 1 ♀ (I.McT.C.)
Vancouver, 16.I.45, ex *Neürotrichus g. gibbsii*, 5♂, 8 ♀ (H.D.F.)

Specimens examined: 7♂, 9 ♀, including the type of "*N. hygini columbiana*".

Family 4, CERATOPHYLLIDAE Dampf 1908 (syn. DOLICHOPSYLLIDAE Baker 1905)*

Eyes usually well developed and heavily pigmented, but reduced to vestiges in a few genera. Antennal fossae open; segments of clava of antennae distinct. Head capsule with trabecula centralis and/or tentorial arms visible in eye region. Genal ctenidia present in one subfamily.

Pronotal ctenidium present. Mesonotum with pseudosetae originating under the collar, and metanotum always with apical spinelets arising from the posterior edge of the sclerite (fig. 3, cf. Hystrichopsyllidae). Anterior abdominal terga with apical spinelets and two or more rows of setae. Antepygidial setae present. Pygidium always flat in lateral aspect, and with hair-like spicules between the trichobothria relatively broad at their bases (cf. Hystrichopsyllidae).

* The name Dolichopsyllidae has priority by three years, and has been much used, especially in American literature on Siphonaptera. However, the International Rules do not rigidly specify the observance of priority in categories above genera, especially when a name is unsuitable, as this certainly is. As Dampf (1945:59) quotes, from letters received from Jordan "I agree with you in objecting to Dolichopsyllidae as the name for Ceratophyllidae. The name of a family must not be taken from the name of a non-typical genus, and *Dolichopsyllus* is quite evidently outside the mass of species formerly united in the one genus *Ceratophyllus*, until J. Wagner began to break the genus up". Also—"To have an aberrant genus as nomenclatorially typical for the family or the subfamily is very awkward, not to say absurd".

Males with tergum VIII large to very large, and sternum VIII large to vestigial. Claspers with single moveable process, frequently armed with pigmented spine-like setae. Acetabular setae present in most genera. Posterior arm of sternum IX typically bifurcate and with more or less complex lobes. Apodemal rod always attached to angle of sternum IX, and extending anteriorly as part of the skeletal support of the endophallus.

Females with anal stylet. Single spermatheca.

Four subfamilies, all occurring in Canada.

Subfamily A. Amphipsyllinae Dampf 1945.

Eye present and pigmented, but may be somewhat reduced. Trabecula centralis present or absent. Anterior arms of tentorium visible in the genal area. Upper seta in ocular row at or near margin of antennal fossa, above level of eye. Pre- and postantennal regions of head always with oblique rows of setae.

Tergum and sternum of abdominal segment VIII of males each expanded posteriorly, sharing the responsibility of protecting the external genitalia. Males lacking acetabular setae. Gland of Wagner lacking. Hind coxae with or without a patch of short hairs or spinelets on the inner surface.

Chiefly an Old World group, but containing four genera in North America, of which all but one *(Geusibia)* have been recorded from Canada.

AMPHIPSYLLA Wagner

Genotype: *Amphipsylla schelkovnikovi* Wagner 1908 (palaearctic)
Amphipsylla Wagner 1908, Mitteil. d. Kaukasisch. Mus. 4:196.
Amphipsylla Wagner. Jordan and Rothschild 1913, The Zoologist 869:401-402.

Preantennal region of head strongly rounded (Pl. XXI, fig. 155). Setae of antennal segment II short. Three rows of setae across pre- and postantennal regions. Eyes moderately pigmented, but distinctly reduced, semi-lunar. Labial palpus shorter than fore coxa. No trabecula centralis. Tentorial arms conspicuous. No spinelets on inside of hind coxae. Moveable process of clasper of male with some pigmented spines. Basal pair of plantar bristles on all tarsi V shifted ventrally.

Holarctic. Three species have been described from North America, but one of these, *A. neotomae* I. Fox 1940 seems to the present writer to be quite obviously generically misplaced. One *Amphipsylla*, regarded as a race of an Asiatic species, is recorded from Canada. *Amphipsylla* is typically a northern genus, and is usually found on microtines.

AMPHIPSYLLA SIBIRICA POLLIONIS (Rothschild)

(Plate XXI, figs. 155, 156, 157; Map 12)

Ceratophyllus pollionis Rothschild 1905, Nov. Zool. 12:171-172; pl. IX, figs. 28, 31, 32. Both sexes from Red Deer, Alta., ex "*Microtus drummondi*" (*M. pennsylvanicus d.*) and "*Evotomys saturatus*" (*Clethrionomys gapperi loringi*).
Amphipsylla pollionis (Rothschild). Jordan and Rothschild 1913, Zoologist:405-406.
Amphipsylla sibirica pollionis (Rothschild). Wagner 1936, Can. Ent. 68(9):195.

This flea may be commoner in the far north of Canada than in the vicinity of its type locality. One female from Lake Athabaska, northern Alberta, represents the only specimen collected since the original small series of 1905.

New Canadian record:

Alta.: Fort Chipewyan, 18.VI.45, ex *Clethrionomys gapperi athabascae*, 1 ♀ (W.F.)

Specimens examined: 1 ♀ (Figure of ♂ after Rothschild).

CTENOPHYLLUS Wagner

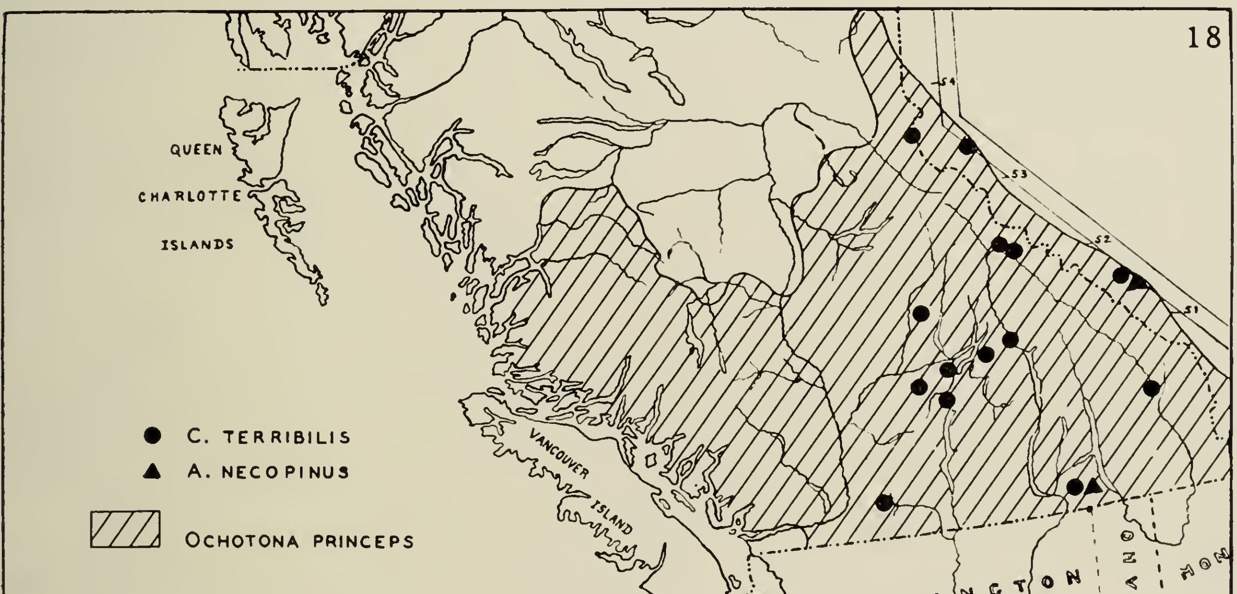
Genotype: *Ceratophyllus armatus* Wagner 1901 (palaearctic)
Ctenophyllus Wagner 1927, Konowia 6:108,112.
Ctenophyllus Wagner. Jordan 1933, Nov. Zool. 39:70-71.
Ctenophyllus Wagner. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:72.

Eyes well developed and pigmented. Pre- and postantennal regions each with three rows of setae. Most of the setae (about 5 in the ♂, 8 in the ♀) along the frontal margin characteristically thickened and spine-like (Pl. XXI, figs. 158, 160). Gena with tentorial arm showing as internal rod-like structure. Five lateral plantar bristles on all tarsi V. Inside of hind coxae with patch of thin hairs.

Male. Sternum VIII large and broad and reinforced on each side by a Y-shaped thickening of the chitin. F mostly concealed by the clasper, and not bearing spiniforms (fig. 159).

Female. Sternum VII with a small ventral sinus (in the single North American species) and about four setae on each side. Head of spermatheca sub-globular (fig. 161).

A holarctic genus, and like *Amphalius*, specific to pikas *(Ochotona)* in the Old World and the New. Four species are known, one of which occurs in the mountains of western North America.



MAP 18
Ceratophyllidae:Amphipsyllinae and Ceratophyllinae. Locality records of the pika-fleas *Ctenophyllus terribilis* (Rothschild) and *Amphalius necopinus* (Jordan), superimposed on the range of *Ochotona princeps* ssp., modified after Howell 1924, by I. McT. Cowan.

CTENOPHYLLUS TERRIBILIS (Rothschild)

(Plate XXI, figs. 158, 159, 160, 161; Map 18)

Ceratophyllus terribilis Rothschild 1903, Nov. Zool. 10:317-318; pl. IX, figs. 1-3. Both sexes from Banff, Alta. and "Canadian National Park" (Banff) Alta., ex "*Lagomys princeps*" (*Ochotona p. princeps*).
Ctenophyllus terribilis (Rothschild). Jordan 1933, Nov. Zool. 39:70-71.
Ctenophyllus terribilis (Rothschild). Wagner 1936, Can. Ent. 68(9):195. "doubtless its area extends into B.C.".
Ctenophyllus terribilis (Rothschild). Holland 1940, Ent. Soc. B. C. Proc. 36:11. Recorded from Reno Mountain (nr. Salmo); Mt. Dunn; and from a rockslide 5 miles west of Salmon Arm, B.C., all ex *Ochotona princeps* ssp.
Ctenophyllus terribilis (Rothschild). Jellison 1940, Pub. Hlth. Repts. 56(49):2341-2349; figs. 1-2. Reviews the species, and gives additional British Columbia records: Robbin's Range and Tappen, ex *Ochotona princeps brooksi;* Okanagan, ex *Ochotona p. cuppes*. Also recorded from various races of *O. princeps* in Oregon, Montana, Utah and Colorado.

The species is probably coincident with the range of *Ochotona* in North America, although, as yet, it has not been taken from the Cascade pika *(O. p. brunnescens)* in British Columbia. These fleas are extremely active, and will leave a host animal within a minute or so of its death.

New Canadian records:

B.C.: Berg Lake, Mt. Robson, 26.VII.44, ex *Ochotona p. princeps*, 1♂, 1♀ (G.P.H.)
Copper Creek, 8.V.42, ex *O. p. fenisex*, 5♂, 6♀ (G.P.H.)
Emperor Falls, Robson, 29.VII.44, ex *O. p. princeps*, 1♀ (G.P.H.)
Goodfellow Ck., 15.VIII.45, ex *Ochotona*, 1♂, 1♀ (G.C.C.)
Kinbasket Lake, 6.VIII.43, ex *Ochotona princeps* ssp., 3♂, 6♀ (G.P.H.), 8.VIII.44, ex *Ochotona princeps* ssp., 3♂, 4♀ (G.P.H.)
Mt. Begbie, 7.VIII.41, ex *Ochotona princeps cuppes*, 1♀ (G.P.H.)
Paradise Mine, 25.VIII.44, ex *Ochotona p. princeps*, 1♀, (G.P.H.)
Sicamous, 18.V.45, ex *Ochotona p. brooksi*, 1♂, 1♀ (G.P.H.)
Sullivan River, 13.VIII.44, ex *Ochotona princeps* ssp., 8♂, 4♀ (G.P.H.)

Alta.: Mt. Edith Cavell (Jasper), 1.VII.44, ex *Ochotona p. princeps*, 1♂ (I.McT.C.)

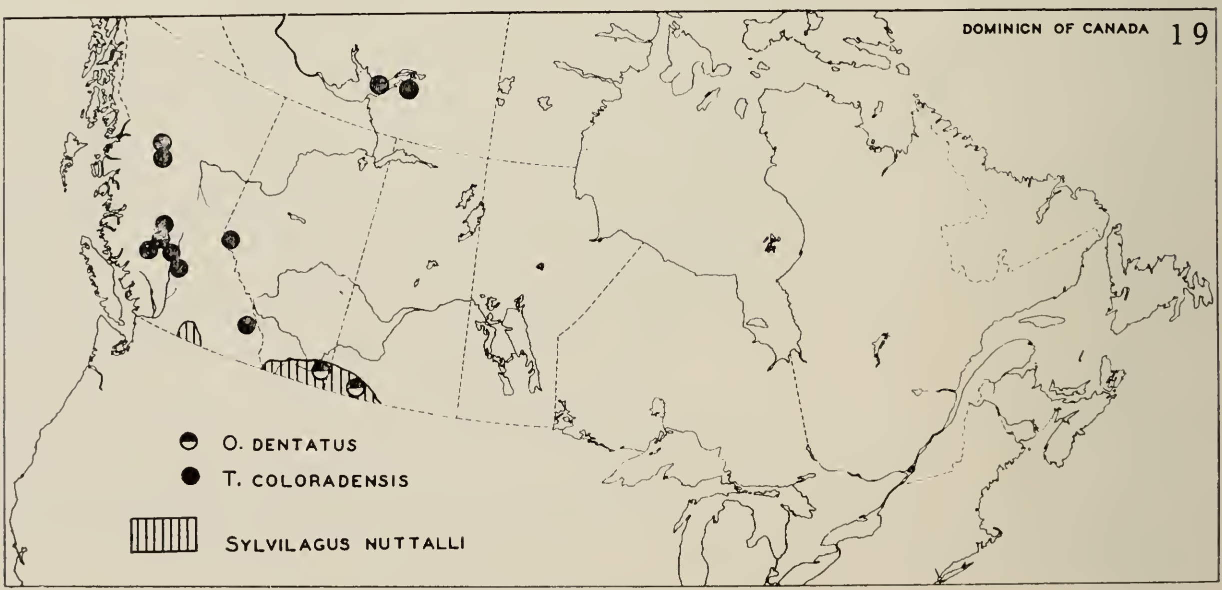
Specimens examined: 37♂, 53♀, including 1♂ and 4♀ topotypes.

ODONTOPSYLLUS Baker

Genotype: *Pulex multispinosus* Baker 1898
Odontopsyllus Baker 1905, U. S. Nat. Mus. Proc. 29:129,131,145.
Odontopsyllus Baker. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:25.

Eyes well developed and heavily pigmented. Trabecula centralis and anterior tentorial arms visible in head capsule. Anterior row of setae on pre-antennal region not thickened and pigmented. Coxa III with a patch of spinelets on inner surface (fig. 163).

A holarctic genus, containing one species from Spain and two from North America. Normal hosts are rabbits. The genotype occurs in the eastern United States and has not yet been collected in Canada. The remaining species, *O. dentatus* (Baker), a western flea, has been taken in this country.



MAP 19

Ceratophyllidae:Amphipsyllinae and Ceratophyllinae. Locality records of *Odontopsyllus dentatus* (Baker), (superimposed on the range of western cottontails, *Sylvilagus nuttalli* ssp., modified after Nelson 1909 by I. McT. Cowan), and *Tarsopsylla coloradensis* (Baker).

ODONTOPSYLLUS DENTATUS (Baker)

(Plate XXI, fig. 162; plate XXII, figs. 163, 164, 165; Map 19)

Ceratophyllus dentatus Baker 1904, U. S. Nat. Mus. Proc. 27:386,390,441. Male described, from Moscow, Idaho, ex *Lynx canadensis*.
Odontopsyllus dentatus (Baker). Baker 1905, U. S. Nat. Mus. Proc. 29:131,145.
Ceratophyllus ponerus Rothschild 1909, Nov. Zool. 16:54; pl. VIII, fig. 5. Synonym, fide Ewing and Fox (1943:25).
Odontopsylla (sic!) *spenceri* Dunn 1923, Pub. Hlth. Repts. 47: 2765:2766. Synonym, fide Kohls (1940-20).
Odontopsyllus dentatus (Baker). Kohls 1940, Nat. Inst. Hlth. Bul. 175:3-4,20-24; map 8; pl. III, figs. C. E.
Odontopsyllus multispinosus (Baker). Brown 1944, Ann. Ent. Soc. Amer. 37:209. (err. determ.). Recorded under this name from Alberta, ex cottontail rabbits, *Sylvilagus* sp. A specimen from Brown's collection has been examined by the writer, who regards it as *dentatus*.

The range of this large dark flea is probably coincident with that of the mammal genus *Sylvilagus* in the southern Prairie Provinces of Canada.

New Canadian records:

Alta.: Elkwater, 6.VI.40, ex *Sylvilagus nuttalli grangeri*, 1♂, 2♀ (G.P.H.)
Sask.: Climax, V.46, ex *Sylvilagus* sp., 3♀ (J.C.)

Specimens examined: 3♂, 7♀, including the type ♂ (U. S. N. M.)

SUBFAMILY B. DOLICHOPSYLLINAE BAKER 1905.

Restricted in the present paper, as recommended by Dampf (1945:59) to contain only the remarkable genus *Dolichopsyllus*. The name has been much used in the literature to include genera allocated here to the *Amphipsyllinae* and *Ceratophyllinae*.

Eyes absent. Trabecula centralis and anterior tentorial arms visible in genal area of head capsule. Pre- and postantennal regions not moveable, separated by a sulcus, but the fused suture clearly visible in both sexes. Head with oblique rows of setae.

Tergum VIII of males large, partially enclosing the external genitalia. Sternum VIII reduced, membranous, and lacking "gland of Wagner". Males with acetabular setae. Tergum VII (especially in males) produced posteriorly between the two sets of antepygidial setae. Inside surface of coxa III without a patch of spinelets.

DOLICHOPSYLLUS Baker

Genotype: *Ceratophyllus stylosus* Baker 1904
Dolichopsyllus Baker 1905, U. S. Nat. Mus. Proc. 29:127, 135 (as *Dolichopsylla*), 155.
Dolichopsylla Baker. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:29.

Size huge (♀♀ up to 6 mm.). Characters as defined for the subfamily, of which it is the only known member.

Moveable process of clasper of male broad, and armed with a number of marginal setae (fig. 167). Two acetabular setae. Armature of F etc. difficult to discern accurately unless the overlying tergum VIII, which has many setae laterally and marginally, be removed. Usually three antepygidial setae.

Females usually with four antepygidial setae. Sternum VII with a pronounced lobe and sinus (fig. 168). Head of spermatheca not a great deal broader than tail.

Strictly nearctic; only a single species is known. This is genetically associated with the "mountain beaver" *(Aplodontia)*, and like its mammal host, has no close relatives.

DOLICHOPSYLLUS STYLOSUS (Baker)

(Plate XXII, figs. 166, 167, 168, 169, 170; Map 12)

Ceratophyllus stylosus Baker 1904, U. S. Nat. Mus. Proc. 27:388,418,420,447; pl. XIV, figs. 1-7. Both sexes from Astoria, Oregon, ex *Aplodontia rufa*.
Dolichopsyllus stylosus (Baker). Baker 1905, U. S. Nat. Mus. Proc. 29:127,135,155.

This large species is apparently a true parasite of the "mountain beaver" *(Aplodontia)*, and its distribution is governed by the range of that peculiar mammal—along the Pacific coast lowlands of British Columbia, Washington, Oregon and California.

It is now recorded for the first time in Canada.

New Canadian record:

B.C.: Huntingdon, 4.VI.42, ex *Aplodontia r. rufa*, 3♂, 5♀ (K.R.) (I.McT.C.)

Specimens examined: 3♂, 5♀. Also the type series (U. S. N. M.)

SUBFAMILY C. CERATOPHYLLINAE DAMPF 1908.

Nearly all the genera included here were split off from the unwieldy *Ceratophyllus* Curtis. While Wagner commenced the splitting up of this large genus, the greater number of the new genera were separated by Jordan in 1933.

Eyes usually present. Trabecula centralis conspicuous, always appearing as an oval dark spot at the anterior margin of the antennal fossa (see figs. 3 and 4)., Anterior tentorial arms not visible in genal region. Upper ocular seta on a level with middle of eye (except if eye is vestigial). Head capsule without conspicuous oblique rows of setae in both pre-and postantennal regions (except in *Dasypsyllus*, *Pleochaetis*, *Jellisonia* and one or two species of *Megabothris*). Females with pre- and postantennal regions of head capsule completely fused, no sign of an interantennal suture remaining.

Tergum VIII of males highly specialized, being expanded into a huge plate, almost completely enclosing the external claspers and aedeagus. Sternum VIII variously reduced: to a mere vestige in one or two genera, but more frequently to a slender rod-like sclerite which usually has characteristic setae and membranous appendages. Conspicuous fimbriated intersegmental membranes between abdominal sterna VIII and IX in some genera. Gland of Wagner associated with base of sternum VIII except in a very few cases, usually where this sclerite is vestigial. Males almost always with acetabular setae at or near the insertion of the moveable process of the claspers. Hind coxa without a patch of spiniforms on the inner surface.

Jordan (1933:71) further divides these genera into three groups as follows:

A. On outer surface of fore femur, one or no lateral seta.

B. A number of small setae on outer surface of fore femur. Longish thin setae on inner surface of mid- and hind coxae from base to apex (apart from those at anterior margin).

C. Fore femora as in B. No longish thin setae in basal half of mid and hind coxae.

Twenty genera belonging to this subfamily are known from North America. Of these, fifteen are known to occur in Canada, *Diamanus*, *Thrassoides*, *Pleochaetis*, *Jellisonia* and *Mioctenopsylla* not having been recorded to date.

OROPSYLLA Wagner and Ioff

Genotype: *Ceratophyllus silantiewi* Wagner 1898 (palaearctic)

Oropsylla Wagner and Ioff 1926, Revue de Microbiol. et d'Epidemiol. 5:86.

Oropsylla Wagner and Ioff. Jordan 1933, Nov. Zool. 39:73-74.

Aetheopsylla Stewart and Holland 1940, Can. Ent. 72(2):41.

Oropsylla Wagner and Ioff. Jellison 1945, Journ. Parasitol. 31(2):83-97.

Eyes large and well pigmented. Clypeal tubercle small. Labial palpus long, extending beyond fore trochantera. Fore femur with a number of lateral setae. Inner anterior surface of mid and hind coxae with setae from base to apex. Basal abdominal sternite without a patch of setae on the side (cf. *Opisocrostis*, p. 126).

Males with sternum VIII long and narrow (Plate XIII, fig. 178), with long setae, but without apical membranous appendage. Moveable process broad, with setae, but no spiniforms. One long and one minute antepygidial seta.

Females with three or more antepygidial setae. Head of spermatheca longer than broad, pyriform. Tail of spermatheca with conspicuous terminal appendage. Sternum VII never deeply sinuate.

A holarctic genus, its species infesting *Citellus* and *Marmota* in Asia and North America. Four Nearctic species are known to date, all occurring in Canada. The genus in North America has recently been very completely reviewed by Jellison.

Key to the nearctic species of *Oropsylla*

1. ♂. Normally with one acetabular seta on each side.
   ♀. Head and tail of spermatheca of almost exactly equal length 2

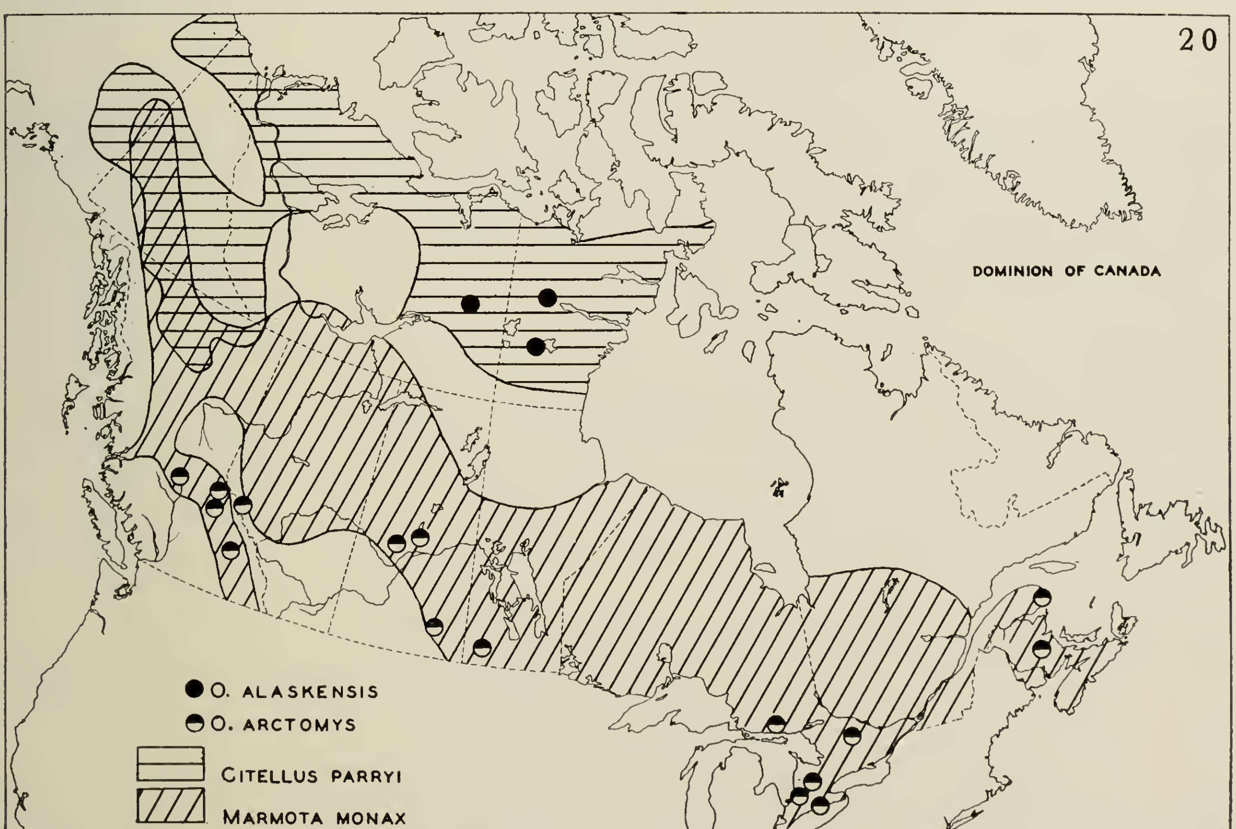
   ♂. Normally with two acetabular setae.
   ♀. Tail of spermatheca distinctly longer than head 3

2. Normal host *Marmota monax* ssp.
   ♂. F distinctly longer than P (Pl. XXIII, fig. 172)
   ♀. Usually with 4 antepygidial setae on each side, or 4 on one and 3 on the other. .*arctomys*

   Normal host *Citellus r. richardsonii.*
   ♂. F barely exceeding P (fig. 178)
   ♀. Three antepygidial setae .... *rupestris*

3. Occurring on *Citellus* in the Arctic.
   ♂. P broadly rounded and as high, if not higher than F (fig. 174).
   ♀. Posterior margin of sternum VII making a wide obtuse angle (fig. 175) .... *alaskensis*

   Normally on *Citellus lateralis* and *C. columbianus*, but known from the North on other *Citelli.*
   ♂. P more pointed, shorter than F (fig. 176)
   ♀. Margin of sternum VII usually sloping gradually, without marked angle...... *idahoensis*



MAP 20

Ceratophyllidae:Ceratophyllinae. Locality records of *Oropsylla alaskensis* (Baker), superimposed on the range of arctic ground squirrels *Citellus parryi*, after Howell 1938), and *O. arctomys* (Baker), (superimposed on range of woodchucks, *Marmota monax* ssp., modified after Howell 1915, by I McT. Cowan).

OROPSYLLA ALASKENSIS (Baker)

(Plate XXIII, figs. 174, 175; Map 20)

Ceratophyllus alaskensis Baker 1904, U. S. Nat. Mus. Proc. 27:387,394-395,440. Both sexes from Point Barrow, Alaska, ex "*Citellus barrowensis*" (*C. parryi barrowensis*).

Oropsylla alaskensis (Baker). Wagner 1929, Konowia 8:313.

Oropsylla alaskensis (Baker). Holland 1944, Can. Ent. 76(12):246; pl. XVIII, figs. 8,9. Recorded from the Thelon Game Sanctuary, N.W.T., ex *Citellus p. parryi* and Baker Lake, N.W.T., ex *Citellus p. parryi*. Both sexes illustrated.

Oropsylla alaskensis (Baker). Jellison 1945, Journ. Parasitol. 31(2):94:95; plates I, II. Redescription of the species. Repeats Holland's records (1944) and in addition records specimens from Baker Lake, N.W.T., ex" *Mustela arctica*" (*M. erminea arctica*) and from Craig Harbour, Ellesmere Island, ex *Alopex lagopus innuitis* from material loaned by the Kamloops Laboratory.

The species is not sufficiently well known for definite statements to be made with regard to its range and host affinities, but it seems probable that its distribution will be found to be rather closely associated with the ground squirrels of the *Citellus parryi* group.

New Canadian record:

N.W.T.: Yathkyed Lake, Keewatin, 6.VIII.30, ex *Citellus* sp. *(C. parryi parryi?)* 1 ♀

Specimens examined: 2 ♂, 9 ♀, including the ♂ and ♀ types (U. S. N. M.)

OROPSYLLA ARCTOMYS (Baker)

(Plate XXIII, figs. 171, 172, 173; Map 20)

Ceratophyllus arctomys Baker 1904, U. S. Nat. Mus. Proc. 27:388,411-412,440; pl. XXII, figs. 1-6. Both sexes from Peterboro, New York, ex "*Arctomys monax*" (*Marmota monax*).

Oropsylla arctomys (Baker). Wagner 1936, Can. Ent. 68(9):198. Recorded from Vavenby, B.C., ex "black marmot" (*Marmota monax petrensis*).

Aetheopsylla septentrionalis Stewart and Holland 1940, Can. Ent. 72(2):41-42; text-figs. 1,2. Described from one female, collected at Wigwam Mine, B.C., ex *Marmota monax petrensis*. Synonym, fide Holland 1941 and Jellison 1945.

Oropsylla arctomys (Baker). I. Fox 1940, Fleas of Eastern U. S. 45-46; pl. IX, figs. 40,41,43.

Oropsylla arctomys (Baker). Jellison 1945, Journ. Parasitol. 31(2):88-92; pl. I, II. Redescription of the species. Many records, of which the following from Canada (provided by this laboratory): Eagle River, B.C., ex *Marmota caligata okanagana*, Quick, B.C., ex *Canis latrans*, Wigwam Mine, B.C., ex *Marmota monax petrensis* Vavenby, B.C., ex *Marmota m. petrensis*. Big River, Sask., ex *Marmota* sp., and Kendal, Sask. ex man.

Oropsylla arctomys is undoubtedly a true parasite of the "woodchuck", *Marmota monax* ssp. On rare occasions it has been recorded on *Marmota flaviventris*, and, not so rarely, on *Marmota caligata*. It should be mentioned that the ranges of *M. monax* and *M. caligata* overlap in certain parts of British Columbia, whereas *M. flaviventris* is seldom in contact with these other marmots.

O. arctomys is more nearly related to *O. rupestris* than to other members of the genus.

New Canadian records:

B.C.: Horsefly, VI.46, ex *Marmota monax* ssp., 1 ♂, 1 ♀ (L.J.)
Teltierone Lake, 5.IX.44, ex *Marmota monax*, 1 ♀ (J.A.M.)

Alta.: Byng Pass (Jasper), 24.VIII.43, ex *Marmota caligata* ssp., 1 ♀ (I.McT.C.)

Sask.: Prince Albert National Park, 2.V.35, ex "bear", 7 ♀ (G.D.)

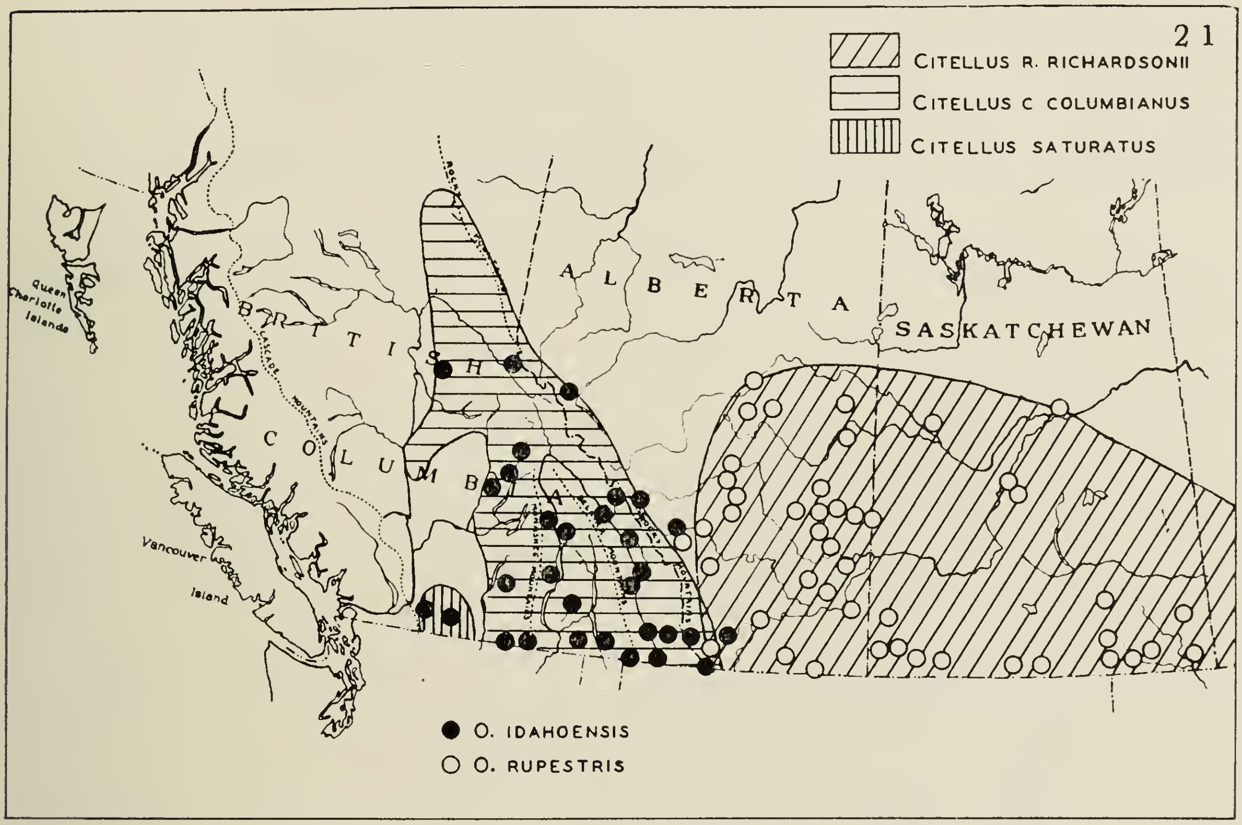
Man.: Aweme, 15.I.14, ex *Taxidia taxus taxus*, 2 ♂, 2 ♀ (S.C.) (det. as *Ceratophyllus bruneri* by N.C.R.!)

Ont.: Brule Lake, Algonquin Park, 11.IX.45, ex *Vulpes fulva*, 3 ♂, 9 ♀ (C.D.F.)
Byron, 29.III.30, ex *Marmota monax rufuscens*, 1 ♀ (E.D.)
Guelph, 23.V.30, ex *Marmota monax* ssp., 1 ♂
Kawene, 2.IX.45, ex *Marmota monax* ssp., 80 ♂, 155 ♀ (A.C.B.) (total of 235 fleas from a single marmot!)
Pancake Bay, Algoma, 16.VII.35, ex *Mephitis m. mephitis*, 1 ♂ (C.H.D.C.)
Polly Creek, Algonquin Park, 25.XI.38, ex *Martes pennanti pennanti*, 2 ♀
Pottageville, 29.IV.34, ex *Marmota monax* ssp., 1 ♂
St. Thomas, 22.VIII.19, ex *Marmota monax* ssp., 2 ♂, 2 ♀
York Co., 1.I.32, ex *Sylvilagus* sp., 1 ♂, 4 ♀

Que.: Percé, 19.VI.15, ex *Marmota monax* ssp., 5 ♂, 7 ♀ (P.A.T.)

N.B.: Scotch Lake, ex *Marmota monax* ssp., 1 ♂, 3 ♀

Specimens examined: large series, of both sexes, including the ♂ and ♀ types (U. S. N. M.)



MAP 21

Ceratophyllidae:Ceratophyllinae. Locality records of the ground squirrel-fleas *Oropsylla idahoensis* (Baker) and *O. rupestris* (Jordan), superimposed on the ranges of *Citellus c. columbianus*, *C. saturatus* and *C. r. richardsonii*, modified after Howell 1938.

OROPSYLLA IDAHOENSIS (Baker)

(Plate XXIII, figs. 176, 177; Map 21)

Ceratophyllus idahoensis Baker 1904, U. S. Nat. Mus. Proc. 27:388,413-415,443; pl. XVIII, figs. 1-7. Both sexes, from Moscow, Idaho, ex *Citellus columbianus*.

Ceratophyllus poeantis Rothschild 1905, Nov. Zool. 12:155-156; pl. VIII, figs. 22-23. Both sexes from Banff, Alta., ex "mountain chipmunk", "Say's Mountain chipmunk" (both *Citellus lateralis tescorum?*), "Mountain gopher" and "*Spermophilus columbianus*" (both *Citellus c.?*); Alberta, ex "*Putorius longicaudatus*" (*Mustela frenata* ssp.), Golden, British Columbia, ex "yellow-bellied marmot" (*Marmota* sp.? (not *flaviventris*)—or possibly *Citellus columbianus*—which has an orange belly) and some other records. Synonym, fide Jordan 1929:32.

Oropsylla idahoensis (Baker). Wagner 1936, Can. Ent. 68(9):198. Recorded from Birch Island, Blackpool, Roundtop, Rutland "etc.", ex *Citellus columbianus*.

Oropsylla (*Oropsylla*) *idahoensis* (Baker). Brown 1944, Ann. Ent. Soc. Amer. 37(2): new records from Alberta: Atlee, Manyberries, Camrose, Stanmore. Hosts: *Citellus richardsonii*, *Speotyto cunicularia*, etc. Author's note: records from such points as Manyberries and Stanmore, many miles from the range of the mountain *Citelli* appear questionable, and should be carefully re-checked as they are out of line with all other available distribution data on this species of flea.

Oropsylla idahoensis (Baker). Jellison 1945, Journ. Parasitol. 31(2):95-96; pl. I, II. Redescription of the species. Many records, of which the following from Canada: British Columbia; Isaac Creek, ex *Citellus columbianus*, Mt. Begbie, ex *C. columbianus*. Alberta: Jasper National Park, ex *C. colombianus;* Banff, ex *C. columbianus* and *C. lateralis*.

O. idahoensis is a common parasite of ground squirrels in western North America and ranges from Alaska southwards to Arizona. Jellison (1945) has discussed the status of this flea fully.

In Canada it is confined to British Columbia and western Alberta, and probably the Yukon, although we have no records from that territory. The common hosts are mantled ground squirrels, *Citellus (Callospermophilus) lateralis* group, which are rarely infested with any other species of flea, and Columbian ground squirrels *(Citellus columbianus)* which have, in addition to *idahoensis*, three other species, *Thrassis petiolatus* (Baker), *Opisocrostis t. tuberculatus* (Baker) and *Neopsylla inopina* Rothschild.

Oropsylla idahoensis is chiefly a flea of the mountains, and ground squirrels collected at high altitudes are rarely infested with any other species. At the lower levels, *T. petiolatus* is the dominant flea of *Citellus columbianus*, with *O. tuberculatus* and *N. inopina* turning up not uncommonly in the extreme southeast of British Columbia, and the southern foothills of Alberta (see maps 10, 21 and 23).

According to the findings of Eskey and Haas (1940), *Oropsylla idahoensis* is resistant to plague infection. So also is *T. petiolatus*, the other common flea of *Citellus columbianus*.

New Canadian records:

B.C.: Athalmer, 17.VII.40, ex *Citellus c. columbianus*, 2♂, 1♀ (S.P.Crew)
Barkerville, 18.VI.46, ex "*striped gopher*", 2♀ (L.J.)
Berg Lake, 5500', 27.VIII.44, ex *Citellus lateralis tescorum*, 1♂, 3♀ (G.P.H.)
Canal Flats, 28.IV.40, ex *C. columbianus*, 1♂, 4♀ (S.P.Crew)
Cascade, 8.VI.40, ex *C. columbianus*, 1♂, 1♀ (S.P.Crew)
Corbin, 8.V.40, ex *C. columbianus*, 1♂ (S.P.Crew)
Cranbrook, 20.V.40, ex *C. columbianus*, 1♂, 2♀ (S.P.Crew)
Creston, 24.V.40, ex *C. columbianus*, 1♂ (S.P.Crew)
Crow's Nest Pass, 16.V.40, ex *C. columbianus*, 1♂ (S.P.Crew)
Dunn Peak, 7000', 10.VIII.37, ex *C. columbianus*, 1♂, 1♀ (G.P.H.)
Fernie, 10.V.40, ex *C. columbianus*, 1♂ (S.P.Crew)
Field, 3.VIII.40, ex *C. columbianus*, 1♂, 1♀ (S.P.Crew)
Foghorn Range, 6000', 12.VIII.31, ex *C. columbianus*, 2♀ (T.K.M.)
Galloway, 7.V.40, ex *C. columbianus*, 3♀ (S.P.Crew)
Golden, 6.VIII.40, ex *C. columbianus*, 6♂, 5♀ (S.P.Crew)
Grand Forks, 13.VI.40, ex *C. columbianus*, 2♂, 1♀ (S.P.Crew)
Invermere, 11.VII.40, ex *C. columbianus*, 1♀ (S.P.Crew)
Kaslo, 19.IV.40, ex *C. columbianus*, 1♂ (S.P.Crew)
Kelowna, 10.IV.40, ex *C. columbianus*, 1♂ (S.P.Crew)
Lempriere, V.45, ex "gopher" *(C. columbianus)*, 3♂, 4♀ (O.F.)
Nakusp, 3.VI.40, ex *C. columbianus*, 2♂, 2♀ (S.P.Crew)
Nelson, 29.V.40, ex *C. columbianus*, 2♀ (S.P.Crew)
Newgate, 9.V.40, ex *C. columbianus*, 1♂ (S.P.Crew)
Paradise Mine, 7800', 25.VIII.44, ex *Ochotona p. princeps*, 2♀ (G.P.H.). 26.VIII.44, ex *Mustela frenata cribasa*, 1♂ (G.P.H.); 27.VII.44, ex *C. columbianus*, 1♂ (G.P.H.)
Princeton, 5.IV.39, ex *Citellus saturatus*, 1♀ (J.B.P.)
Radium Springs, 29.VII.40, ex *C. columbianus*, 13♂, 14♀ (S.P.Crew)
Robson, 16.IV.40, ex *C. columbianus*, 2♀ (S.P.Crew)
Roosville, 14.V.40, ex *C. columbianus*, 3♂, 4♀ (S.P.Crew)
Salmo, 2.VI.40, ex *C. columbianus*, 2♂, 2♀ (S.P.Crew)
Slocan, 5.VI.40, ex *C. columbianus*, 2♂, 2♀ (S.P.Crew)
Timberline Valley, Manning Park, 2.VIII.45, ex *Citellus saturatus*, 1♂ (G.C.C.)
Vavenby, various dates, ex *C. columbianus*, 6♂, 10♀
Windermere, 14.VII.40, ex *C. columbianus*, 2♀ (S.P.Crew)
Winlow, 30.VI.40, ex *C. columbianus*, 1♂, 1♀ (S.P.Crew)
Yahk, 24.IV.40, ex *C. columbianus*, 1♂ (S.P.Crew)

Alta.: Canmore, 29.VII.43, ex *C. columbianus*, 2♂, 1♀ (S.P.Crew)
Maligne Lake, 10.V.45, ex *Microtus longicaudus mordax*, 1♂ (I.McT.C.)
McLeod, 24.VII.40, ex *Citellus r. richardsonii* (S.P.Crew)
Twin Butte, 29.VII.40, ex *C. columbianus*, 6♂, 4♀ (S.P.Crew)
Waterton, 22.VI.38, ex *Thomomys talpoides andersoni*, 1♂ (G.P.H.). 22.VI.38, ex *Citellus 13-lineatus* ssp., 1♂ (G.P.H.)

Specimens examined: large series, of both sexes, including the ♂ and ♀ types (U.S.N.M.)

OROPSYLLA RUPESTRIS (Jordan)

(Plate XXIII, figs. 178, 179; Map 21)

Ceratophyllus rupestris Jordan 1929, Nov. Zool. 35:32; pl. I. figs. 8,9. Both sexes from Alberta: Calgary (type locality) ex "*Putorius longicauda*" (*Mustela frenata l.*) and "*Spermophilus richardsonii*" (*Citellus r.*); "Blackfalls" (Blackfalds) ex *Thomomys* and *Canis;* "Dorthy" (Dorothy) ex *Thomomys*. Female was described as *Opisocrostis labis* Jordan and Rothschild 1922.

Oropsylla rupestris (Jordan). Holland 1944, Ent. Soc. B. C. Proc. 41:10-11. Note on plague importance.

Oropsylla (Oropsylla) rupestris (Jordan). Brown 1944. Ann. Ent. Soc. Amer. 37(2):210. Various Alberta records, including Lethbridge, Stanmore, Atlee, Waterton, Camrose, Youngstown and Sunnynook. New host record *Taxidia taxus*.

Oropsylla rupestris (Jordan). Jellison 1945, Journ. Parasitol. 31(2):92-94; pl. I, II. Redescription of the species. Many records, including the following from Canada; Alberta, Calgary, ex *C. richardsonii*, Edmonton, ex *Citellus*, sp., High River, ex *C. richardsonii*. Saskatchewan: Estevan, ex *Mustela* sp., Rock Glen, ex *C. richardsonii*, Saskatoon, ex *C. richardsonii*, Val Marie, ex *Mustela* sp.

Oropsylla rupestris is the commonest and most characteristic flea of the Richardson ground squirrel. While taken on many different hosts, it has not been recorded outside the known range of *C. richardsonii* in Canada and the United States. As it has been proved to be an efficient plague vector, it is of considerable medical importance. The writer (1944:11) pointed out its occurrence on rats *(Rattus norvegicus)* as well as on *C. richardsonii* at Estevan, Saskatchewan, a matter a great potential significance in view of the occurrence of plague in ground squirrels in North Dakota along the Canadian border, only a few miles south of Estevan.

The males are readily determined but it is sometimes possible to confuse the females with those of *O. idahoensis* so that collections of fleas from areas inhabited by both Richardson and Columbian ground squirrels should be checked carefully.

New Canadian records:

Alta.: Acadia Valley, 27.VI.44, ex *Citellus r. richardsonii*, 4♂, 1♀ (S.P.Crew)
Aden, 13.VI.40, ex *C. richardsonii*, 4♂, 3♀ (G.P.H.)
Brooks, 21.VII.44, ex *C. richardsonii*, 3♂, 4♀ (S.P.Crew)
Corbin, 4.VII.44, ex *C. richardsonii*, 1♂ (S.P.Crew)
Coronation, 1.VIII.40, ex *C. richardsonii*, 2♂, 1♀ (S.P.Crew)
Delia, 31.V.40, ex *C. richardsonii*, 1♂, 2♀ (S.P.Crew)
Drumheller, 30.VI.44, ex *C. richardsonii*, 4♂ (S.P.Crew)
Hanna, 6.VI.39, ex *C. richardsonii*, 2♂ (S.P.Crew)
MacLeod, 24.VII.40, ex *C. richardsonii*, 1♂, 1♀ (S.P.Crew)
Medicine Hat, VI.43, ex *C. richardsonii*, 4♂, 2♀ (S.P.Crew)
Milk River, 9.VII.38, ex *C. richardsonii*, 1♀ (G.P.H.)
Orkney, 4.VII.44, ex *C. richardsonii*, 1♀ (S.P.Crew)
Oyen, 27.VI.44, ex *C. richardsonii*, 1♂, 1♀ (S.P.Crew)
Red Deer, 16.VII.43, ex *C. richardsonii*, 2♀ (S.P.Crew)
San Francisco, 21.VII.44, ex *C. richardsonii*, 11♂ (S.P.Crew)
Suffield, 4.VII.43, ex *C. richardsonii*, 1♂, 2♀ (S.P.Crew)
Three Hills, 30.VI.44, ex *C. richardsonii*, 2♂, 2♀ (S.P.Crew)
Vermilion, VI.43, ex *C. richardsonii*, 4♂, 1♀ (A.P.Surv.)
Wainwright, 16.VI.43, ex *C. richardsonii*, 1♂, 1♀ (A.P.Surv.)
Wetaskiwin, 5.VII.43, ex *C. richardsonii*, 2♂ (S.P.Crew)

Sask.: Beaubier, 24.VII.43, ex *C. richardsonii*, 1♂, 2♀ (S.P.Crew)
Big River, 5.VIII.43, ex *C. richardsonii*, 1♂ (S.P.Crew)
Carlyle Lake, 18.VII.44, ex *Citellus franklinii*, 1♂, 1♀ (S.P.Crew)
Cavalier, 22.IX.46, ex *C. richardsonii*, 17♂, 22♀ (W.F.)
Ceylon, 28.VII.43, ex *C. richardsonii*, 3♂, 1♀ (S.P.Crew)
Climax, 24.VIII.43, ex *C. richardsonii*, 10P, 11♀ (S.P. Crew)
Dundurn, 27.V.43, ex *C. richardsonii*, 2♂, 1♀ (A.P.Surv.)
Frontier, 3.VIII.43, ex *C. richardsonii*, 4♂, 4♀ (S.P.Crew)
Gainsborough, 10.VII.43, ex *C. richardsonii*, 1♂, 1♀ (S.P.Crew)
Glen Ewen, 10.VII.43, ex *C. richardsonii*, 1♂ (S.P.Crew)
Govenlock, 2.IX.43, ex *C. richardsonii*, 9♂, 10♀ (S.P.Crew)
Lake Alma, 25.VII.43, ex *C. richardsonii*, 4♂, 2♀ (S.P.Crew)
Loomis, 1.IX.43, ex *C. richardsonii*, 1♂ (S.P.Crew)
Maple Creek, 29.V.43, ex *C. richardsonii*, 1♀ (S.P.Crew)
Masefield, 21.VIII.43, ex *C. richardsonii*, 5♂, 5♀ (S.P.Crew)
Minton, 30.VII.43, ex *C. richardsonii*, 3♂, 1♀ (S.P.Crew)
Norbury, V.45, ex *C. richardsonii*, 1♂, 11♀ (D.V.)
Oungre, 22.VII, ex *C. richardsonii*, 4♂, 4♀ (S.P.Crew)
Outram, 25.VII.44, ex *Mustela frenata longicauda*, 2♂, 4♀ (S.P.Crew)

Prince Albert, 24.VI.43, ex *C. richardsonii*, 2♂, 1♀ (S.P.Crew)
Regina, XII.43, ex *Lepus campestris* ssp., 1♂, 1♀ (F.B.). VI.43, ex *C. richardsonii*, 6♂, 4♀ (A.P.Surv.)
Torquay, 27.VII.43, ex *C. richardsonii*, 3♂, 1♀ (A.P.Surv.)
Val Marie, 8.VII.42, ex *C. richardsonii*, 3♂, 1♀ (A.P.Surv.) 3♀ (G.P.H.). 18.IX.42, ex *Cynomys l. ludovicianus*, 2♂, 1♀ (W.F.)

Man.: Brandon, 8.VIII.43, ex *C. richardsonii*, 3♂, 4♀ (A.P.Surv.)
Shilo, ex *C. richardsonii*, 3♂ (A.P.Surv.)

Specimens examined: large series, of both sexes, including 21♂ and 19♀ topotypes.

THRASSIS Jordan

Genotype: *Ceratophyllus acamantis* Rothschild 1905
Thrassis Jordan 1933, Nov. Zool. 39:72-73.
Thrassis Jordan. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:44.

Eye well developed. Clypeal tubercle present. Bristles of pedicel of antenna long in both sexes. Fore femur with a number of lateral setae. Anterior inner surfaces of coxae II and III with long thin setae from base to apex. Basal abdominal sternum with one or no lateral sera in upper anterior area (cf. *Opisocrostis*, p. 126 and *Oropsylla*, p. 112). Five pairs of plantar bristles, all lateral, on all tarsi V.

Males with one long and one minute antepygidial seta. Sternum VIII comparatively large and broad, without a filamentous apical appendage. F narrow or short, without pigmented spiniforms, and tending to be directed frontad. Proximal lobe of ventral arm of sternum IX frequently with characteristic pigmented straplike setae. Penis rods coiling no more than once.

Females with two or three antepygidial setae. Stylet with two or three longish lateral setae. Head of spermatheca subglobular, higher than long. Tail much longer than head, and with terminal process or papilla. No sclerification at the base of the ducts of the bursa copulatrix.

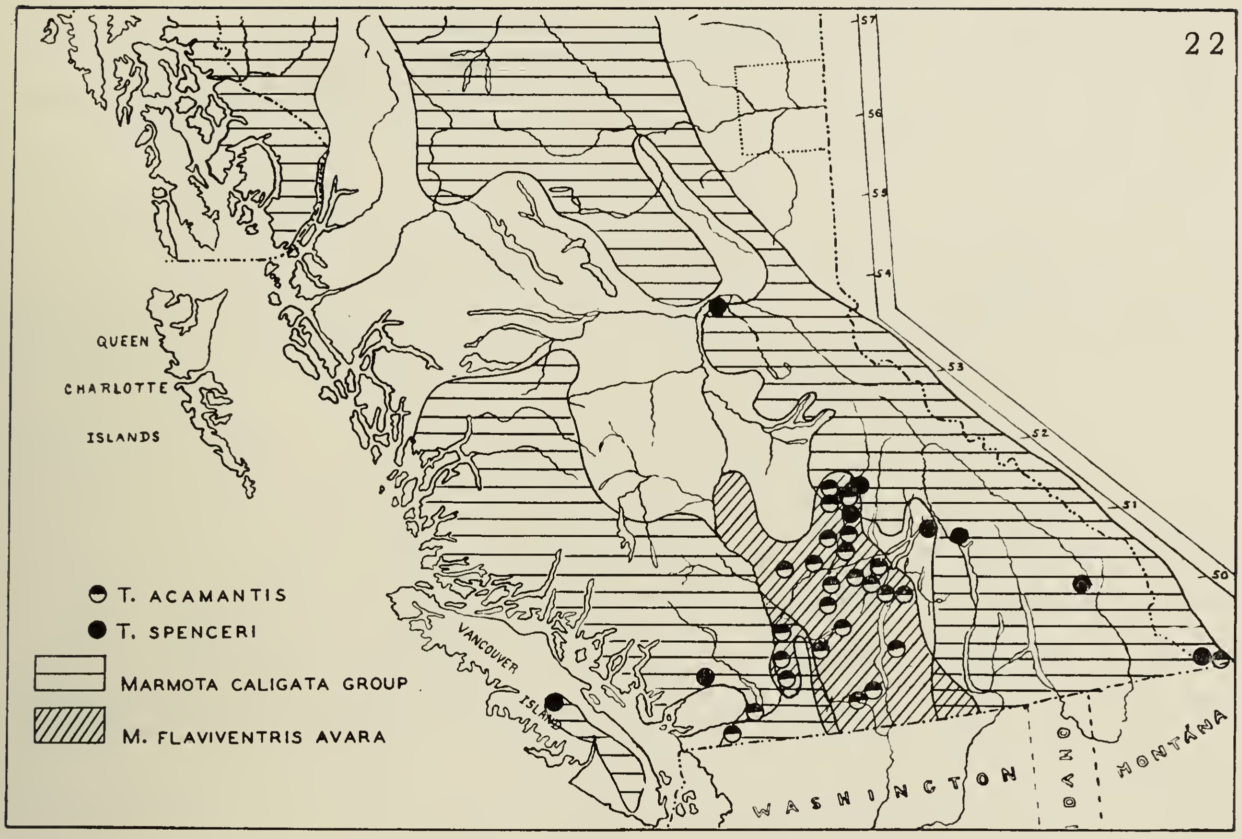
Thrassis is an exclusively nearctic genus, in which over a score of species and subspecies are recognized at the present time. (Some of these were separated by Hubbard in 1947 as a separate genus, *Thrassoides*). Most members of the genus *Thrassis* occur on various species of *Marmota* and *Citellus*, although a few have been described from mice. Nearly all the species occur in the western United States, four extending northwards into Canada.

Key to the Canadian species of *Thrassis*

1. ♂. Apex of manubrium curving upwards (Pl. XXIV, fig. 185)
   ♀. Two antepygidial setae . . . . *petiolatus*
   ♂. Manubrium straight, or curving downwards very slightly
   ♀. Three antepygidial setae 2

2. Labial palpus extending slightly to well beyond fore trochanter. On *Marmota*, from the Rockies, west 3
   Labial palpus barely attaining apex of fore trochanter. On *Citellus*, from the Rockies, east . . . . *bacchi*

3. Normally on *Marmota flaviventris* ssp.
   ♂. Dense row of about 25 setae (per side) on ventral margin of Tergum III. Aedeagal crochet slender (fig. 181)
   ♀. Sternum VII usually with small sinus (fig. 182) . . . . *acamantis*
   Normally on *Marmota caligata* ssp.
   ♂. Tergum VIII with but 10-15 setae on ventral margin. Crochet broader (fig. 187)
   ♀. Sternum VII usually entire (fig. 188) . . . . *spenceri*



MAP 22

Ceratophyllidae:Ceratophyllinae. Locality records of the marmot-fleas *Thrassis acamantis* (Rothschild) and *T. spenceri* Wagner, superimposed on the ranges of yellow-bellied marmots, *Marmota flaviventris avara* and alpine marmots, *Marmota caligata* group, as outlined by I. McT. Cowan.

THRASSIS ACAMANTIS (Rothschild)

(Plate XXIV, figs. 181, 182; Map 22)

Ceratophyllus acamantis Rothschild 1905, Nov. Zool. 12:156-158; pl. 8, figs. 24,25. Both sexes from "*Mephitis spissigrada*" (*M. mephitis s.*) and "*Arctomys flaviventris avarus*" (*Marmota f. a.*), Okanagan, B.C.; ♀ from Sumas, B.C., ex "*Putorius energumenos*" (*Mustela vison e.*); Eagle River, B.C., ex *Canis latrans*. (See discussion of these last two records under *T. spenceri*, p. 122).

Thrassis acamantis (Rothschild). Jordan 1933, Nov. Zool. 39:72-73.

Thrassis acamantis (Rothschild). Wagner 1936, Can. Ent. 68(9):197; pl. II, fig. 7 A (not 7 B as stated). Recorded from British Columbia as follows: Black Pines, Boulder, Chinook Cove, Darlington, Falkland, Hat Creek, Heffley, "Janieson" ((Jamieson Creek), Kamloops, "Lake Road" (Heffley Lake road), Mt. Olie, Nicola, Rayleigh, Roundtop, Salmon Arm, Shuswap, Tranquille, Trapp Lake, Vinsulla and Westsyde, all from *Marmota flaviventris avara*.

Thrassis acamantis (Rothschild). Spencer 1936, Ent. Soc. B. C. Proc. 32:13. Recorded from the following hosts, without reference to locality: "Marmot" (*M. flaviventris avara*), "Vanc. Is. Marmot" (*Marmota vancouverensis* and Columbia ground squirrel (*Citellus c. columbianus*). Author's note: Spencer's authority for these records was correspondence with Dr. Wagner. See *Thrassis spenceri* for discussion of the record of *acamantis* from Vancouver Island marmot.

Thrassis acamantis (Rothschild). Wagner 1936, Zeitsch. of Parasitenk. 8(3):322,340-342; text-figs. 10,11.

Thrassis acamantis (Rothschild). Brown 1944, Ent. Soc. Amer. Ann. 37:210. Recorded from Waterton, Alta., ex "*Marmota flaviventris avara*" (*M. f. nosophora?* Waterton is out of the range of *avara*).

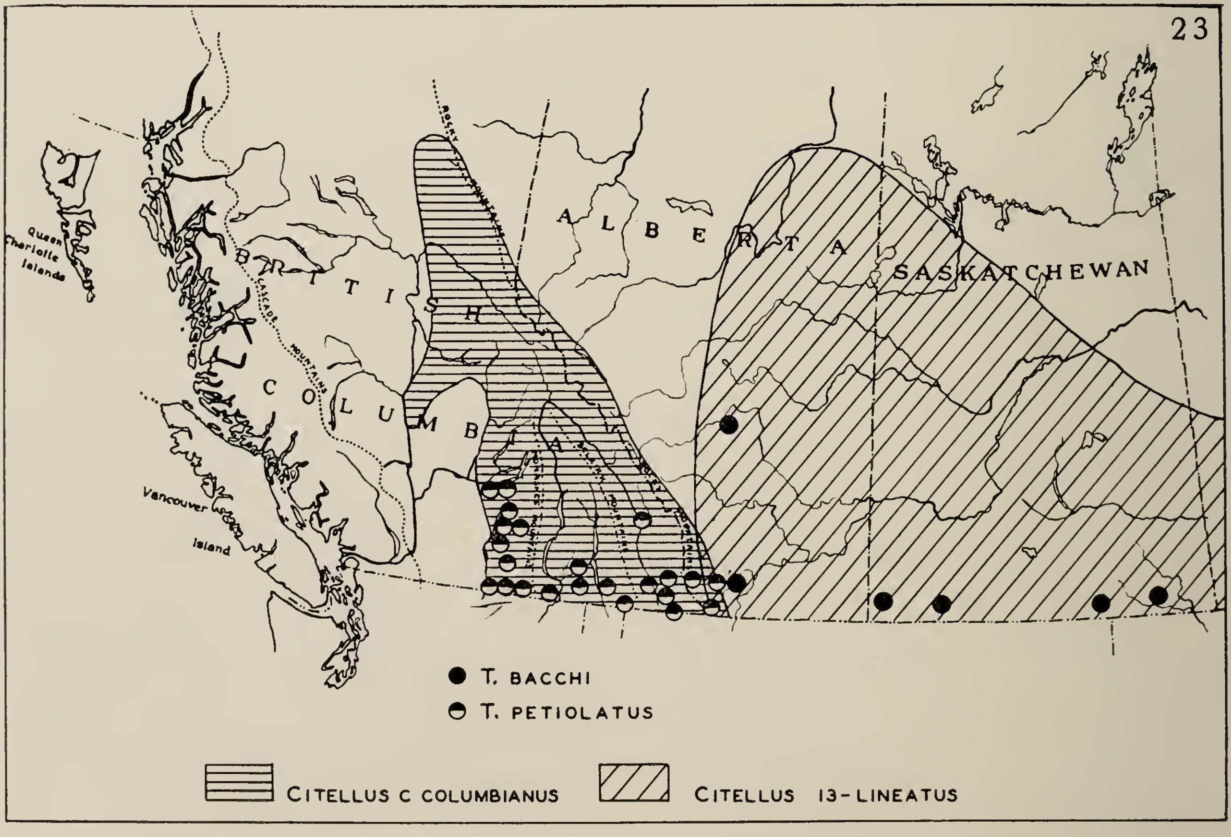
Thrassis acamantis is an extremely common parasite of the pallid yellow-bellied marmot, and appears to occur throughout the range of that mammal, which, in Canada, coincides roughly with the "Interior dry belt" of British Columbia. The females are almost indistinguishable from those of *T. spenceri* (which see) and the writer feels that some of the published records for *acamantis*, established on females, may refer to the latter species. This would include Rothschild's records from Sumas and Eagle River, and Spencer's record from Vancouver Island marmot. Specimens recorded from Seward, Alaska, ex *Marmota caligata* by Jellison and Kohls (1939:2023) also should be compared with *spenceri*.

T. acamantis is highly specific, and rarely taken from other mammals even within the range of its host. Marmots shot in the early spring sometimes have over one hundred of these fleas, many pairs of them being in copulo. Eskey and Haas (1940) have shown *acamantis* to be a potential plague vector.

New Canadian records:

B.C.: Agassiz (questionable record) 15.VI.34, ex *Marmota* sp., 5♂, 11♀ (W.R.)
Boston Bar, 17.IV.35, ex *Marmota flaviventris avara*, 1♂, 2♀ (T.K.M.)
Canoe, 12.VI.38, ex *M. f. avara*, 3♂, 1♀ (G.A.M.)
Chapmans, VI.39, ex *M. flaviventris* ssp., 108♂, 225♀ (L.C.C.); 24.VI.39, ex *Eutamias* sp., 1♂ (L.C.C.)
Chase, 16.V.45, ex *M. f. avara*, 10♂, 13♀ (G.P.H.)
Douglas Lake, 16.VI.30, ex *M. f. avara*, 6♀ (E.H.)
Kelowna, 9.VI.30, ex *M. f. avara*, 4♀ (E.H.)
Keremeos, 28.III.39, ex *M. f. avara*, 53♂, 47♀ (S.P.Crew)
Lytton, 11.VII.36, ex *M. f. avara*, 8♂, 24♀ (J.D.G.)
Napier Lake, 1.IV.37, ex *M. f. avara*, 6♂, 11♀ (G.P.H.)
Pass Lake, 3.VIII.33, ex *M. f. avara*, 5♂, 13♀ (E.H.)
Pritchard, VI.45, ex *M. f. avara*, 35♂, 64♀ (G.P.H.)
Quilchena, 26.VI.33, ex *M. f. avara*, 4♂, 1♀ (E.H.)
Rayleigh, 9.VIII.33, ex *M. f. avara*, 1♂, 2♀ (E.H.); 8.VII.35, ex *M. f. avara*, 36♂, 38♀ (T.K.M.); 5.II.41, ex nest of *Tamiasciurus hudsonicus streatori*, 2♂, 2♀ (G.P.H.)
Shumway Lake, 21.VI.33, ex *M. f. avara*, 9♂, 11♀ (E.H.); 23.VI.39, ex *M. f. avara*, 16♂, 21♀ (G.P.H.)
Tappen, 24.V.40, ex *M. f. avara*, 4♂, 3♀ (G.P.H.)
Vernon, 21.V.41, ex *M. f. avara*, 3♂, 10♀ (C.D.F.)

Specimens examined: large series, of both sexes, including many near topotypes.



MAP 23

Ceratophyllidae:Ceratophyllinae. Locality records of the ground squirrel-fleas *Thrassis bacchi* (Rothschild) and *T. petiolatus* (Baker), superimposed on the ranges of *Citellus tridecemlineatus* ssp. and *C. c. columbianus*, modified after Howell 1938.

THRASSIS BACCHI (Rothschild)

(Plate XXIV, figs. 180, 183, 184; Map 23)

Ceratophyllus bacchi Rothschild 1905, Nov. Zool. 12:159-160; pl. IX, fig. 34. Male, from Red Deer, Alta., ex "*Spermophylus 13-lineatus*" (*Citellus 13-l.*).

Thrassis bacchi (Rothschild). Prince 1944, Pan-Pac. Ent. 20(1):18; pl. I, fig. 7. Description of female.

Thrassis gladiolis gladiolis (Jordan). Brown 1944, Ent. Soc. Amer. Ann. 37:211. Recorded under this name from Squaw Butte, Alta., ex *Citellus 13-lineatus*. Author's note: Mr. Brown has kindly allowed me to examine his specimens, and in my opinion, they are *bacchi*.

This small flea occurs sparsely across southern Alberta, Saskatchewan and Manitoba. While recorded from a number of hosts, it is probably most closely associated with the thirteen-lined ground squirrel. Prince (1943:1013) proved it to be a potential plague vector.

New Canadian records:

Alta.: Twin Butte, 29.VII.40, ex *Citellus r. richardsonii*, 1♂ (S.P.Crew)

Sask.: Dundurn, 28.V.43, ex *C. r. richardsonii*, 3♀ (A.P.Surv.)
Estevan, 27.VI.42, ex *Citellus 13-lineatus*, 1♂ (G.P.H.); 20.VII.42, ex *Mustela frenata longicauda*, 4♀ (W.F.); 28.VII.42, ex *Citellus r. richardsonii*, 4♂, 6♀ (W.F.)
Govenlock, VIII-IX.43, ex *C. r. richardsonii*, 2♂, 3♀ (S.P.Crew)
Minton, 30.VII.43, ex *C. r. richardsonii*, 1♀ (S.P.Crew)
Saskatoon, 5.VI.43, ex *C. r. richardsonii*, 1♂ (A.P.Surv.)
Val Marie, 18.IX.42, ex *Cynomys l. ludovicianus*, 2♂ (W.F.)

Man.: Brandon, 2.VIII.43, ex *C. r. richardsonii*, 1♀ (A.P.Surv.)

Specimens examined: 14♂, 21♀.

THRASSIS PETIOLATUS (Baker)

(Plate XXIV, figs. 185, 186; Map 23)

Ceratophyllus petiolatus Baker 1904, U. S. Nat. Mus. Proc. 27:388,415-416,446; pl. XVIII, figs. 8-11. Male, from Moscow, Idaho, ex *Lynx canadensis*.

Ceratophyllus petiolatus Baker. Jordan 1929, Nov. Zool. 35:31. Supplementary description, including female. Recorded from British Columbia, and *Thomomys* listed as a host.

Ceratophyllus petiolatus Baker. Jordan 1929, Trans. 4th. Int. Cong. Entom. 2:495-496; text-figs. 4, a, b. Discussion of variability, and illustration of dimorphic st. VII (♀).

Thrassis petiolatus (Baker). Jordan 1933, Nov. Zool. 39:73.

Thrassis petiolatus (Baker). Jellison 1937, Pub. Hlth. Repts. 52(23):726-729; text-figs. 3,5,6.

Thrassis petiolatus (Baker). Hubbard 1942, Pac. Univ. Bul. 38(6):2-4, figs.

Thrassis petiolatus (Baker). Brown 1944, Ent. Soc. Amer. Ann. 37:211. Recorded from Waterton, ex *Citellus columbianus*.

Thrassis petiolatus is without doubt a true parasite of Columbian ground squirrels *(Citellus columbianus)* but appears to infest these mammals only in areas of low altitude (below 4000'). Where the same mammals occur in the mountains (up to 8500'), they do not carry this flea, but are regularly parasitized by *Oropsylla idahoensis* (Baker) which, conversely, is less common in the bottom lands. Furthermore, *T. petiolatus* appears to be confined to the southern part of the area inhabited by *C. columbianus* in Canada, not being known north of Shuswap Lake, B.C. A study of these two common fleas might yield information on the control of flea distribution by climatic factors independent of the range of the preferred host.

Jordan (1929) remarked on the wide variation in sternum VII in the females of this species; this structure is either strongly rounded and broad (fig. 186 a-c) or much reduced in width from above, the dorsal margin running almost parallel with the ventral, and the apex truncate-subsinuate (fig. 186 d-e). Hubbard (1942:3) illustrates many variations, showing an almost continuous series grading from one type to the other. In our material from British Columbia, the great bulk of the females are of one type or the other, as shown in fig. 186, there being but very few intermediate forms.

New Canadian records:

B.C.: Baynes Lake, 9.VI.36, ex *Citellus c. columbianus*, 2♂, 1♀ (T.K.M.)
Beaverdell, 20.VI.40, ex *C. columbianus*, 1♂, 2♀ (S.P.Crew)
Cascade, 8.VI.40, ex *C. columbianus*, 1♂, 1♀ (S.P.Crew)
Corbin, 8.V.40, ex *C. columbianus*, 1♂ (S.P.Crew)
Cranbrook, 24.V.40, ex *C. columbianus*, 3♂, 3♀ (S.P.Crew); 22.IV.40, ex *Eutamias* sp., 1♂ (S.P.Crew)
Creston, 24.V.40, ex *C. columbianus*, 1♂, 1♀ (S.P.Crew)
Crow's Nest, 18.V.40, ex *C. columbianus*, 1♂ (S.P.Crew)
Eholt, 5.VI.40, ex *C. columbianus*, 1♂, 1♀ (S.P.Crew)
Fernie, 12.V.40, ex *C. columbianus*, 1♂ (S.P.Crew)
Flagstone, 17.V.40, ex *C. columbianus*, 1♂, 1♀ (S.P.Crew)
Ft. Steele, 1.V.40, ex *C. columbianus*, 3♂ (S.P.Crew)
Galloway, 7.V.40, ex *C. columbianus*, 2♂, 1♀ (S.P.Crew)
Grand Forks, 17.VI.40, ex *C. columbianus*, 1♀ (J.B.P.)
Greenwood, 19.VI.40, ex *C. columbianus*, 1♀ (S.P.Crew)
Kelowna, 6.V.38, ex *C. columbianus*, 1♂, 1♀ (S.P.Crew); 11.V.44, ex *C. columbianus*, 16♂, 18♂ (G.P.H.)
Kimberley, 14.IV.38, ex *C. columbianus*, 1♀ (J.B.P.)
Madeline Lake 6.V.37, ex *C. columbianus*, 3♂, 4♀ (G.P.H.)
McCulloch, 15.V.42, ex *C. columbianus*, 1♀ (G.P.H.)
Nelson, 29.V.40, ex *C. columbianus*, 1♂ (S.P.Crew)
Newgate, 9.V.40, ex *C. columbianus*, 1♀ (S.P.Crew)
Okanagan Centre, 6.VI.37, ex *C. columbianus*, 2♂, 7♀ (G.P.H.)
Osoyoos, 2.VII.40, ex *C. columbianus*, 3♂ (S.P.Crew)
Robson Town, 16.IV.40, ex *C. columbianus*, 2♂ (S.P.Crew)
Rock Creek, 24.VI.40, ex *C. columbianus*, 1♀ (S.P.Crew)
Roosville, 14.V.40, ex *C. columbianus*, 2♂ (S.P.Crew)
Salmo, 2.VI.40, ex *C. columbianus*, 1♂, 1♀ (S.P.Crew)
Salmon Arm, 25.VI.30, ex *C. columbianus*, 1♂, 4♀ (E.H.)
Wasa, 2.V.40, ex *C. columbianus*, 3♂, 1♀ (S.P.Crew)
Windermere, 27.IV.40, ex *C. columbianus*, 2♂, 1♀ (S.P.Crew)
Winlow, 18.IV.40, ex *C. columbianus*, 1♂ (S.P.Crew)
Yahk, 24.IV.40, ex *C. columbianus*, 2♂, 1♀ (S.P.Crew)

Alta.: Pincher Creek, 17.VI.40, ex *C. columbianus*, 9♂, 14♀ (G.P.H.)

Specimens examined: large series, of both sexes, including the type ♂ (U. S. N. M.)

THRASSIS SPENCERI Wagner

(Plate XXIV, figs. 187, 188: Map 22)

Thrassis spenceri Wagner 1936 (Sept.) Zeitsch. f. Parasitenk. 8(6):654-655. Both sexes from Birch Island, B. C. (actually Granite Mountain. 7000′. near Birch Island), ex "*Marmota* sp." (*M. caligata* ssp.)—types. Also from Eagle River. B.C., ex *Gulo luscus* and "*Ursus horribilis*" (*Ursus* sp.).

Thrassis spenceri Wagner 1936 (Sept.) Can. Ent. 68(9):197-198, pl. II, figs. 5.6.7 B (not 7 A as stated; cf. *T. acamantis*) Both sexes from Birch Island, ex *Marmota* sp., etc.

Diamanus montanus (Baker). Holland 1941. Ent. Soc. B. C. Proc. 37:12. Recorded under this name from Eagle River, ex *Gulo luscus*. Err. det.

T. spenceri is very closely related to *T. acamantis* and would appear to be as characteristic a flea of *Marmota caligata* as the latter is of *M. flaviventris*.

The labial palpus is distinctly shorter than that of *acamantis*, and, in specimens where this organ lies closely parallel to the fore coxa, barely exceeds the apex of the fore trochanter. In *acamantis* the palpus extends well beyond this point.

The ventral margin of tergum VIII in the males has, on each side, a fringe of 10-15 setae as opposed to 25 as occurs in *acamantis*. The basal part of the external aedeagus has a small ventral lobe which in *acamantis* is narrow and pointed, and in *spenceri*, blunt and shaped like a right angle (cf. figs. 181 and 187). This character is somewhat variable. The aedeagal crochets too are characteristic (figures reversed in Wagner's Can. Ent. description)—being more slender and curved in *acamantis* than in *spenceri*.

The females of the two species resemble each other closely. The writer does not find Wagner's character "lower antepygidial bristle in female but little shorter than middle one" reliable. Sternum VII is much more constant than in *acamantis*, where it shows considerable individual variation.

Specimens of both sexes from Vancouver Island tally more closely with *spenceri* than with *acamantis*, despite Spencer's record to the contrary. This record, in any case, was based on a single female. In general, males are necessary for definite identification. Males of Vancouver Island *T. spenceri* show slight differences from mainland specimens. These may be within the limits of individual variation, or it may be that these fleas from isolated populations of alpine marmots warrant recognition as subspecies.

New Canadian records:

B.C.: Aleza Lake, 8.VIII.43, ex *Marmota*, sp., 3 ♀ (L.C.C.)
Dunn Peak, 9.VIII.37, ex *Marmota caligata* ssp., 2 ♂ (G.P.H.)
Garibaldi, 26.VII.39, ex *M. caligata cascadensis*, 44 ♂, 52 ♀ (G.P.H.)
Horsefly, VI.46, ex *Marmota monax* ssp., 1 ♂, 1 ♀ (L.J.)
Isaac Creek, 21.V.39, ex *Marmota monax petrensis* 3 ♂, 8 ♀ (E.R.B.); 10.VI.39, ex *Marmota caligata okanagana*, 3 ♂, 5 ♀ (G.P.H.)
Mt. Washington, Vancouver Island, 30.VIII.43, ex *Marmota vancouverensis*, 11 ♂, 39 ♀ (G.C.C.)
Paradise Mine, 30.VIII.44, ex *M. caligata okanagana*, 1 ♀ (G.C.C.)

Alta.: Banff, 17.VII.39, ex *Marmota caligata* ssp., 9 ♂, 16 ♀ (J.D.G.)
Bertha Lake, Waterton, ex *M. caligata* ssp., 1 ♂, 1 ♀ (J.H.B.)

Specimens examined: 77 ♂, 140 ♀, including the types.

AMPHALIUS Jordan

Genotype: *Ceratophyllus runatus* Jordan and Rothschild 1923. (palaearctic).
Amphalius Jordan 1933, Nov. Zool. 39:74.

Eyes large. Labial palpus reaching apex of fore trochanter. Pronotal ctenidium of twenty-four or more spines. Basal pair of plantar bristles on all tarsi V shifted ventrally. Several small setae on outer surface of fore femur. Long thin setae on inside of mid and hind coxae from base to apex.

Males with one long antepygidial seta and a vestigial one. Moveable process armed apically with a long spine-like seta, and posteroventrally with a characteristic long, apically dilated process (Pl. XXV, fig. 190).

Females having anal stylet robust, with many apical setae (fig. 192). Three antepygidial setae. Spermatheca not noticeably differentiated into head and tail regions (fig. 191).

This interesting genus is holarctic in distribution. Three species are known, two of which occur in eastern Asia, and one in the mountains of western North America. All are normal parasites of pikas (*Ochotona* spp.).

AMPHALIUS NECOPINUS (Jordan)

(Plate XXV, figs. 189, 190, 191, 192; Map 18)

Ceratophyllus necopinus Jordan 1925, Nov. Zool. 32:110; text-fig. 37. Both sexes, from Pine City, Mono Co., California: ex "*Ochotona muiri*" (*O. schisticeps m.*).

Amphalius necopinus (Jordan). Jordan 1933, Nov. Zool. 39:74.

Amphalius necopinus (Jordan). Holland 1941, Ent. Soc. B. C. Proc. 37:12. Recorded from Reno Mt. (nr. Salmo) British Columbia, ex *Ochotona princeps cuppes* and from Banff, Alta., ex *Ochotona p. princeps*.

Amphalius necopinus (Jordan). Jellison 1941, Pub. Hlth. Repts. 56(49):2341-2349; figs. 1,2.

The species appears to be rare, although of wide distribution, having now been found in Alaska, California, Colorado, Alberta and British Columbia.

New Canadian records:

Alta.: Panther River, Banff, 3.VII.43, ex *Ochotona p. princeps*, 1 ♀ (I.McT.C.)
Brewster Creek, Banff, 19.VII.43, ex *Ochotona p. princeps*, 1 ♀ (I.McT.C.)

Specimens examined: 3 ♂, 3 ♀, plus 1 ♂ from Boulder Co., Colorado, ex *Ochotona*, kindness of Wm. L. Jellison.

DACTYLOPSYLLA Jordan

Genotype: *Dolichopsyllus bluei* Fox 1909
Dactylopsylla Jordan 1929, Nov. Zool. 35:37-38.
Dactylopsylla Jordan. Jordan 1933, Nov. Zool. 39:75.
Dactylopsylla Jordan. Ewing and Fox 1943, U.S.D.A. Misc. Pub. 500:39-43.
Dactylopsylla Jordan. Hubbard 1943, Pac. Univ. Bul. 40(2):1-8; figs. and map.

Eye vestigial. Preantennal region with two complete rows of setae (Pl. XXV, fig. 193). A number of small setae on outer surface of fore femur. Longish thin setae on inner surface of mid and kind coxae from base to apex. 1st pair of plantar bristles bent downwards and inwards. Hind tibia with more than 20 stout bristles on dorsal and apical margins (fig. 194). Hind femur with complete row of bristles on each side. Close to *Foxella* (see).

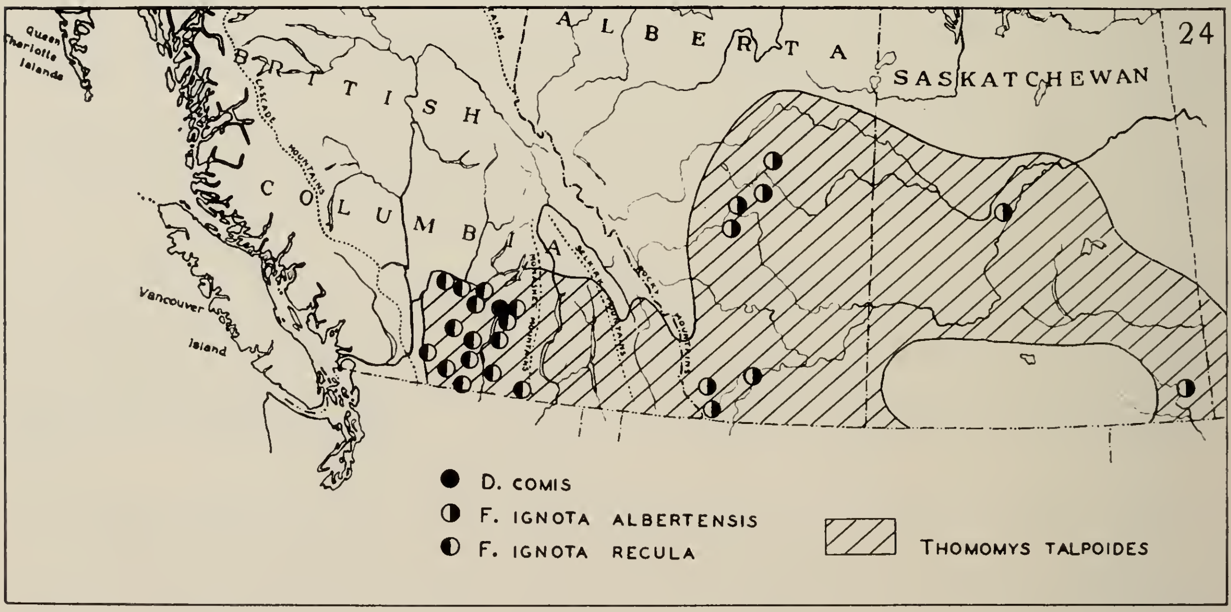
Sternum VIII of male with apical lobe and ventral fringe of setae (fig. 196). F long and narrow, sometimes produced distad at apex.

Spermatheca of female having head broader than long (fig. 197).

As originally conceived by Jordan and Wagner, *Dactylopsylla* and *Foxella* were assigned full generic rank. I. Fox (1940:275) erected *Spicata* as a subgenus of *Dactylopsylla* to accommodate his new species *D.* (*S.*) *rara*. Ewing and Fox (1943:41) reduced *Foxella* to the status of a subgenus. Later the same year, Hubbard erected *Foxelloides*, a further subgenus, to hold *D. comis* Jord., which was previously known only from the female, and two new species. The characters separating these various subgenera pertain principally to details of the male genital armature. Prince (1945:15-20) apparently continues to regard *Foxella* as a full genus, but recognizes Hubbard's *Foxelloides*.

In the present paper, *Foxella* is regarded as generically distinct from *Dactylopsylla*. The one species of *Dactylopsylla* recorded from Canada belongs to the subgenus *Foxelloides*.

All these fleas are neartic, and are normal parasites of pocket gophers, *Thomomys* and *Geomys*.



MAP 24

Ceratophyllidae:Ceratophyllinae. Locality records of the pocket-gopher fleas *Dactylopsylla comis* (Jordan), *Foxella ignota albertensis* (Jordan and Rothschild) and *F. i. recula* (Jordan and Rothschild), superimposed on the range of *Thomomys talpoides* ssp., modified after Bailey 1915, by I. McT. Cowan.

DACTYLOPSYLLA COMIS Jordan

(Plate XXV, figs. 193, 194, 195; plate XXVI, figs. 196, 197; Map 24)

Dactylopsylla comis Jordan 1929, Nov. Zool. 35:38; pl. II, fig. 26. A single female, from Okanagan Landing, B.C., ex "*Thomomys fuscus*" (*T. talpoides* ssp.).

Dactylopsylla (*Foxelloides*) *comis* Jordan. Hubbard 1943, Pac. Univ. Bul. 40(2):3-4; figs. From the Siskiyou and Cascade Mts. of Oregon. Male described and figured.

While the species was described from British Columbia, no Canadian specimens have been collected since. The writer and others have done considerable collecting of pocket gophers in the Okanagan valley and elsewhere in British Columbia, but have never been able to secure specimens of this flea.

Specimens examined: 1 ♂ from "sage rat", Little Lava Lake, Oregon, kindness of Dr. C. A. Hubbard. Figure of ♀ after Jordan.

FOXELLA Wagner

Genotype: *Pulex ignotus* Baker 1895.

Foxella Wagner 1929, Konowia, 8:314.

Foxella Wagner. Jordan 1933, Nov. Zool. 39:75.

Foxella Wagner. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:41. (used as a subgenus).

Much like *Dactylopsylla* (which see, p. 124), but differing as follows:

Smaller. All plantar bristles lateral. Hindtibia with less than 20 stout bristles dorsally and apically (Plate XXVI, fig. 199).

Sternum VIII of male small, without extensive apical lobe, but with one very long seta (figs. 200, 202). Processes of clasper somewhat as in *Dactylopsylla* but F never turned backwards at apex. No acetabular setae.

Head of spermatheca pyriform, longer than broad. Tail of spermatheca with apical papilla.

Strictly nearctic. Two species recognized, of which one, *F. ignota* (Bak.), is represented by nine subspecies, two of which are known from Canada. They may be separated as follows:

Key to the Canadian subspecies of *Foxella ignota*

1. Known from the eastern foothills of the Rockies, eastward through Alberta and Saskatchewan.
   ♂. Tergum VIII with 30-40 setae from the stigma downwards. P and F large. F with four long setae (Pl. XXVI, fig. 202)
   ♀. Sternum VII and spermatheca as in fig. 203 . . . . *ignota albertensis*

   Known only from the Interior of British Columbia.
   ♂. Tergum VIII averaging about 20 setae.
   P and F shorter than in *albertensis*.
   F usually only with three long setae (fig. 200)
   ♀. Sternum VII with fewer setae, and somewhat more variable in contour (fig. 201 a-e).
   Head of spermatheca proportionately smaller . . . . *ignota recula*

FOXELLA IGNOTA ALBERTENSIS (Jordan and Rothschild)

(Plate XXVI, figs. 202, 203; Map 24)

Ceratophyllus ignotus albertendis Jordan and Rothschild 1915, Ectoparasites 1:56; text-figs. 58,60. Both sexes from "Blackfalls" (Blackfalds) Alta., ex "*Geomys* sp." (*Thomomys talpoides* ssp.), *Mustela* sp. and *Lynx canadensis*.

Foxella ignota albertensis (Jordan and Rothschild). Holland 1941, Ent. Soc. B. C. Proc. 37:12. Recorded from Waterton Lakes, Alta., ex "*Thomomys fuscus* ssp." (*T. talpoides andersoni*).

Dactylopsylla (*Foxella*) *ignota albertensis* (Jordan and Rothschild). Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:41.

Dactylopsylla (*Foxella*) *ignota albertensis* (Jordan and Rothschild). Brown 1944, Ent. Soc. Amer. Ann. 37(2):208. Recorded from Camrose and Winterburn, Alta.

New Canadian records:

Alta.: Bashaw, 3.X.34, ex *Thomomys* sp., 3 ♂, 1 ♀
Lethbridge, host not recorded, 1 ♂
Pincher Creek, 17.VI.40, ex *Thomomys talpoides andersoni*, 4 ♂, 1 ♀ (G.P.H.)
Red Deer, 2.VII.42, ex weasel, 3 ♀ (E.T.)

Sask.: Carlyle Lake, 26.VI.42, ex *Thomomys talpoides rufescens*, 2 ♂, 1 ♀ (G.P.H.)
Saskatoon, 26.VIII.39, ex *Thomomys* sp., 8 ♂, 13 ♀

Specimens examined: 26 ♂, 30 ♀.

FOXELLA IGNOTA RECULA (Jordan and Rothschild)

(Plate XXVI, figs. 198, 199, 200, 201; Map 24)

Ceratophyllus ignotus recula Jordan and Rothschild 1915, Ectoparasites 1:58; text-figs. 59,61. Both sexes from Okanagan Landing (type locality) B.C., ex "*Putorius arizonensis*" (*Mustela frenata* ssp.); Okanagan Falls, ex *Thomomys talpoides;* Kelowna, ex *Mustela* sp.

Foxella ignotus recula (Jordan and Rothschild). Wagner 1936, Can. Ent. 68:(9):198. The following British Columbia records: Kamloops and Hedley, ex "*Thomomys f. fuscus*" (*T. talpoides incensus*), Monte Creek and Peterson Creek (Kamloops), ex "*Putorius arizonensis*" (*Mustela frenata* ssp.) and Nicola Ranges, ex "*Mustela suturata*" (*M. frenata nevadensis*).

Dactylopsylla (*Foxella*) *ignota recula* (Jordan and Rothschild). Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:42.

This flea is very common on pocket gophers in the Interior of British Columbia. It seems to be most numerous in the very early spring, becoming increasingly scarce as summer progresses. A single pocket gopher collected at Cherry Creek, January 10, 1945 yielded 53 of these fleas. On the other hand, a series of three dozen gophers, trapped during July, yielded a total of only 27 fleas!

New Canadian records:

B.C.: Allison Pass, 30.VII.45, ex *Thomomys* sp., 8♂, 7♀ (G.C.C.)
Campbell Range, 3.VI.42, ex *Thomomys talpoides incensus*, (G.P.H.)
Cawston, VI.46, ex *Thomomys talpoides* ssp., 1♂ (G.P.H.)
Cherry Creek, 10.I.45, ex *Thomomys t. incensus*, 25♂, 28♀ (G.N.H.)
Kamloops, 20.VII.42, ex *Mustela frenata* ssp., 1♂, 4♀ (G.P.H.)
Okanagan Landing, 17.XII.31, ex *Mustela erminea* sp., 1♂, 2♀ (J.A.M.)
Okanagan Valley, ex *Thomomys t.* ssp., 1♂ (I.McT.C.)
Rock Creek, 18.VI.40, ex *Citellus c. columbianus*, 1♀ (S.P.Crew)
White Lake, VI.45, ex *Thomomys t.* ssp., 1♂ (G.P.H.)

Specimens examined: 66♂, 86♀ including 5♂ and 8♀ topotypes.

OPISOCROSTIS Jordan

Genotype: *Pulex hirsutus* Baker 1895

Opisocrostis Jordan 1933, Nov. Zool. 39:73.

Eyes well developed. Clypeal tubercle distinct. Bristles of pedical of antenna long in both sexes. Basal abdominal sternum with a number of slender setae on upper anterior half. Fore femur with several lateral setae. Mid and hind coxae with long thin setae on inner surface from base to apex.

Sternum VIII of male long and rod-like with two long apical setae and a slender filamentous apical process. Moveable process with setae, but no pigmented spines. Penis rods coiled up. One long and two minute antepygidial setae.

Females with two antepygidial setae, the dorsal one longer. Head of spermatheca sub-globular, higher than long. Tail of spermatheca without apical papilla. A small sclerification in the bursa copulatrix, at the base of the duct and the blind duct.

A strictly nearctic genus in which eight species and subspecies are recognized at present, all normally infesting ground squirrels *(Citellus)* and prairie-dogs *(Cynomys)*. Ewing and Fox (1943:50-51) treat *Opisocrostis* as a subgenus of *Oropsylla*.

Four species are known from Canada. Three of them are confined to the Great Plains region, the fourth occurs in south east British Columbia as well. Future collecting may well reveal that the prairie-dogs *(Cynomys l. ludovicianus)* which occur at Val Marie, Sask., are hosts to *Opisocrostis hirsutus* (Baker), a true prairie-dog flea, and not yet known from Canada. Also, *O. washingtonensis* Good and Prince, may be found in the extreme south of British Columbia.

The known Canadian species may be separated by the following keys.

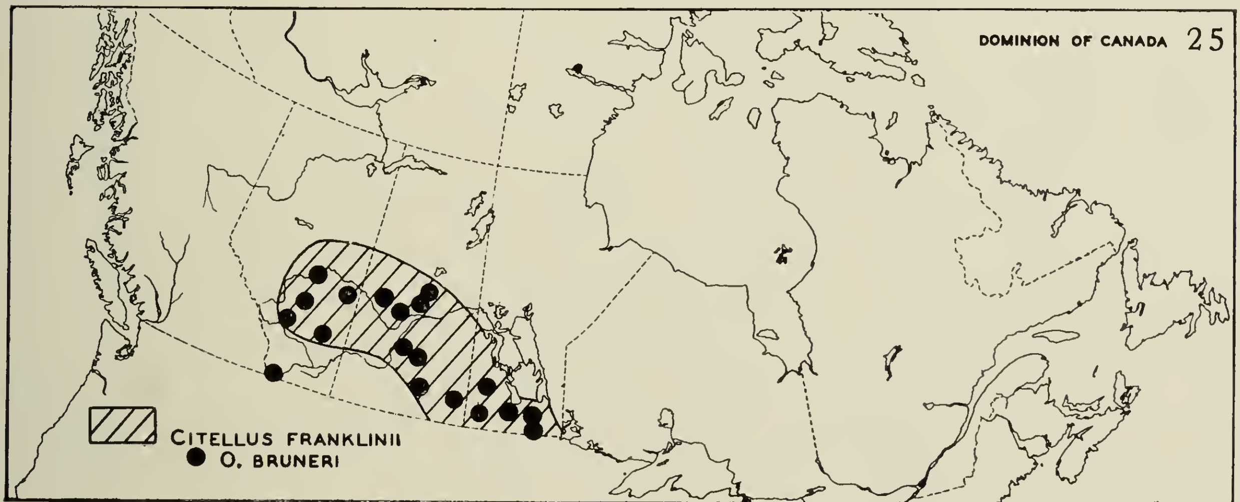
Keys to the Canadian species of *Opisocrostis*

Males

1. F extending for half its length or more beyond P 2
   F extending but little beyond P, crescent shaped, and pointed at apex, and with about 4 long setae on posterior margin (Plate XXVII, fig. 211) . . . . *tuberculatus tuberculatus*
2. F somewhat oblong in shape, with no posteriorly projecting apical process 3
   F long and slender, and curving posteriorly at the apex (fig. 207) . . . . *labis*
3. F approximately 3 times as long as broad. Manubrium curved upwards apically (fig. 205) . . . . *bruneri*
   F less than 2½ times as long as broad. Manubrium straight (fig. 209) . . . . *saundersi*

Females

1. Posterior margin of sternum VII smooth and bluntly obtuse 2
   Sternum VII more or less indented 3
2. Approximately 4 long and 4 short setae on each side of sternum VII (fig. 210) . . . . *saundersi*
   Sternum VII with about 7 long and 7 short setae (fig. 206) . . . . *bruneri*
3. Sternum VII with sharp lobe and very deep sinus (fig. 212) . . . . *tuberculatus tuberculatus*
   Sternum VII irregular, with one small lobe (fig. 208) . . . . *labis*



MAP 25

Ceratophyllidae:Ceratophyllinae. Locality records of *Opisocrostis bruneri* (Baker), superimposed on the range of *Citellus franklinii*, modified after Howell 1938 by I. McT. Cowan.

OPISOCROSTIS BRUNERI (Baker)

(Plate XXVII, figs. 205, 206; Map 25)

Pulex bruneri Baker 1895, Can. Ent. 27:130-132. Both sexes, from Lincoln, Nebraska, ex "*Spermophilus 13-lineatus*" (*Citellus 13-l.*) *and* "*Spermophilus franklinii*" (*Citellus f.*); and Fort Collins, Colorado, ex "*Spermophilus 13-lineatus*".

Ceratophyllus bruneri (Baker). Baker 1904, U. S. Nat. Mus. Proc. 27:388,413,440; pl. XXV, figs. 1-5.

Ceratophyllus bruneri Baker. McLeod, 1933, Can. Journ. Res. 9:111-112. Recorded from Manitoba, ex *Citellus franklinii*, *C. richardsonii* and *C. tridecemlineatus*.

Opisocrostis bruneri (Baker). Jordan 1933, Nov. Zool. 39:73.

Opisocrostis bruneri (Baker). I. Fox 1940, Fleas of Eastern U. S. 43-44; pl. XI, figs. 50,51,53. Redescription.

Opisocrostis bruneri (Baker). Holland 1943. Can. Ent. 75(9):175-176; fig. 1. Description of a female from Blackfalds, Alta., ex *Citellus 13-lineatus*, bearing two spermathecae instead of one.

Oropsylla (*Opisocrostis*) *bruneri* (Baker). Brown 1944, Ann. Ent. Soc. Amer. 37:209. Recorded from Sunnynook and Waterton, Alta., ex *C. richardsonii*, *C. columbianus* and *C. tridecemlineatus*.

Opisocrostis bruneri seems quite definitely to be associated with the Franklin ground squirrel, although upon occasion it is collected from other species of *Citellus* in areas inhabited also by *C. franklinii*. Brown's record from Waterton, Alta (see map 25) is the only one occurring outside of the known range of *C. franklinii*.

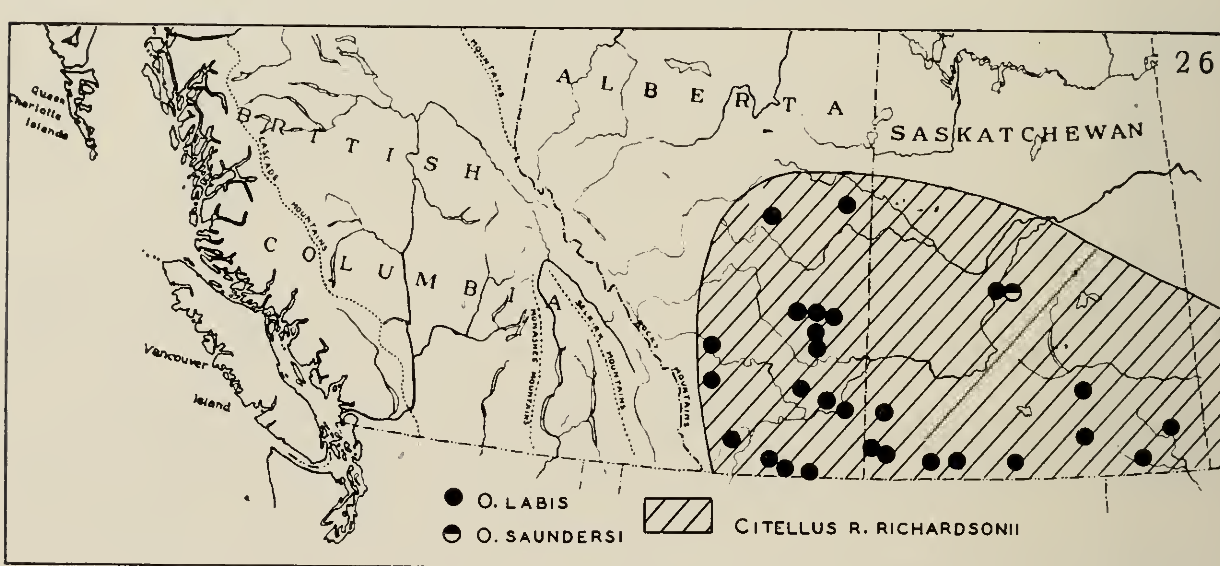
New Canadian records:

Alta.: Blackfalds, 21.VI.40, ex *Eutamias minimus borealis*, 1 ♀ (G.P.H.)
Calgary, 6.VIII.43, ex *Citellus* sp., 1 ♂ (A.P.Surv.)
Edmonton, 26.V.43, ex *Citellus* sp., 1 ♀ (A. P. Surv.)
Vermilion, 4.VII.43, ex *Citellus* sp., 2 ♂ (A.P.Surv.)

Sask.: Big River, 5.VIII.42, ex *Marmota monax* ssp., 1 ♀ (L.G.S.)
Carlyle Lake, 24.VI.42, ex *Citellus franklinii*, 5 ♂, 1 ♀ (G.P.H.); 24.VI.44, ex *Marmota monax* ssp., 1 ♂ (W.F.)
Dundurn, 28.V.43, ex *Citellus* sp., 2 ♂, 1 ♀ (A.P.Surv.)
Emma Lake, 27.V.40, ex "cat", 1 ♀ (L.G.S.)
Norbury, VI.45, ex *Citellus* sp., 3 ♂, 13 ♀ (D.V.)
Pike Lake, 15.VI.32, ex *Citellus franklinii*, 1 ♀ (L.G.S.)
Prince Albert, VI.43, ex *Citellus* sp., 8 ♂, 6 ♀ (A.P.Surv.); 21.VI.43, ex "bush rabbits", 2 ♂, 2 ♀ (A.P.Surv.)
Regina, 26.VI.43, ex *Citellus* sp., 1 ♂ (A.P.Surv.)
Saskatoon, VI.43, ex *Citellus richardsonii*, 3 ♂, 1 ♀ (A.P.Surv.)

Man.: Aweme, 15.I.14, ex *Taxidea t. taxus*, 1 ♂ (S.C.). 9.V.16, ex *Citellus franklinii*, 2 ♂, 2 ♀ (N.C.)
Portage la Prairie, VII.43, ex *Citellus* sp., 3 ♂ 2 ♀ (A.P.Surv.)
Riding Mt. Park, 22.V.35, ex *Citellus 13-lineatus*, 1 ♂, 6 ♀
Shilo, ex *Citellus* sp., 1 ♂, 1 ♀ (A.P.Surv.)
Winnipeg, 10.VIII.43, ex *Citellus* sp., 2 ♂ 1 ♀ (A.P.Surv.)

Specimens examined: 50 ♂, 45 ♀, including the type ♂ (U. S. N. M.)



MAP 26

Ceratophyllidae:Ceratophyllinae. Locality records of *Opisocrostis labis* (Jordan and Rothschild) and *O. saundersi* (Jordan), superimposed on the range of *Citellus r. richardsonii*, modified after Howell 1938.

OPISOCROSTIS LABIS (Jordan and Rothschild)

(Plate XXVII, figs. 207, 208; Map 26)

Ceratophyllus labis Jordan and Rothschild 1922, Ectoparasites 1:275; text-fig. 267. Both sexes described from Calgary, Alberta, ex "*Putorius longicaudatus*" (*Mustela frenata longicauda*). (Female actually was of another species, *Oropsylla rupestris* (See correction by Jordan, 1929.).

Ceratophyllus labis Jordan and Rothschild. Jordan 1929, Nov. Zool. 35:32. Female described.

Opisocrostis labis (Jordan and Rothschild). Jordan 1933, Nov. Zool. 39:73.

Opisocrostis labis (Jordan and Rothschild). Jellison 1939, Pub. Hlth. Rept. 54:841-843.

This species, along with several others, is a common parasite of the Richardson ground squirrel, and appears to occur throughout the range of that mammal (map 26). Certain other fleas (notably *Neopsylla inopina* and *Opisocrostis t. tuberculatus*, which see) while equally common on *Citellus richardsonii*, are frequently found on the Columbian ground squirrel, *C. columbianus*, and have apparently spread from the Great Plains via the Crow's Nest, and probably through other mountain passes which lie southwards, in Montana, until they are now known in Idaho and the southern Kootenay district of British Columbia (see maps 10 and 27). While *O. labis* is exposed to the same opportunities for

transference of host (the ranges of *C. richardsonii* and *C. columbianus* overlapping in the southern foothills region of Alberta, as well as to the south, in the United States) its requirements are apparently much more specific, and examination of large samples of fleas from ground squirrels has given no evidence of its spreading into British Columbia. Whether this situation is to be explained by a very selective specificity towards *C. richardsonii*, or independent climatic requirements which make it impossible for the flea to exist away from the prairie, although *C. columbianus* would otherwise be suitable as a host, is not known.

New Canadian records:

Alta.: Acadia Valley, 27.VI.44, ex *Citellus r. richardsonii*, 1 ♀ (S.P.Crew)
Allerston, 9.VII.38, ex *Mustela frenata longicauda*, 1 ♀ (G.P.H.)
Brooks, 22.VII.44, ex *C. richardsonii*, 1 ♀ (S.P.Crew)
Camrose, 26.VI.43, ex *C. richardsonii*, 5 ♂, 2 ♀ (A.P.Surv.)
Cessford, 8.VII.40, ex *C. richardsonii*, 1 ♂ (S.P.Crew)
Delia, 31.V.40, ex *C. richardsonii*, 1 ♂ (S.P.Crew)
Hanna, 12.V.43, ex *C. richardsonii*, 1 ♂ (A.P.Surv.)
High River, 28.VIII.38, ex *C. richardsonii*, 1 ♂, 10 ♀ (E.C.); 26.VII.38, ex *Mustela frenata longicauda*, 1 ♀ (G.P.H.)
MacLeod, 24.VII.40, ex *C. richardsonii*, 2 ♂ (G.P.H.)
Medicine Hat, 11.VI.43, ex *C. richardsonii*, 2 ♂, 1 ♀ (A.P.Surv.)
Milk River, 28.V.40, ex *C. richardsonii*, 2 ♂, 1 ♀ (G.P.H.)
Oyen, 26.VI.44, ex *C. richardsonii*, 1 ♂ (S.P.Crew)
San Francisco, 21.VII.44, ex *C. richardsonii*, 2 ♂, 5 ♀ (S.P.Crew)
Scotfield, 21.VI.40, ex *C. richardsonii*, 1 ♂ (G.P.H.)
Stanmore, 13.VIII.40, ex *Taxidia t. taxus*, 1 ♂ (S.P.Crew); various dates, ex *C. richardsonii*, 26 ♂ 22 ♀ (S.P.Crew)
Suffield, 25.VI.43, ex *C. richardsonii*, 4 ♂, 2 ♀ (A.P.Surv.)
Summerview, 26.VI.40, ex *C. richardsonii*, 1 ♂ (S.P.Crew)
Sunnynook, 8.VII.40, ex *C. richardsonii*, 1 ♂, 1 ♀ (S.P.Crew)
Vermilion, VI.43, ex *C. richardsonii*, 1 ♂, 1 ♀ (A.P.Surv.)

Sask.: Carlyle Lake, 18.VII.44, ex *C. franklinii*, 2 ♀ (W.F.)
Ceylon, 3.VIII.43, ex *Mustela frenata longicauda*, 1 ♀ (W.F.)
Climax, 24.VIII.43, ex *C. richardsonii*, 2 ♂, 3 ♀ (S.P.Crew)
Estevan, VI-VII.43, ex *C. richardsonii*, 2 ♂, 3 ♀ (S.P.Crew)
Frontier, 31.VIII.43, ex *C. richardsonii*, 1 ♂, 1 ♀ (S.P.Crew)
Govenlock, IX.43, ex *C. richardsonii*, 20 ♂, 8 ♀ (S.P.Crew)
Maple Creek, 28.V.43, ex *C. richardsonii*, 2 ♂, 1 ♀ (A.P.Surv.)
Masefield, 21.VIII.43, ex *C. richardsonii*, 2 ♂ (A.P.Surv.)
Regina, 2.VII.43, ex *C. richardsonii* (A.P.Surv.)
Saskatoon, 5.V.41, ex *C. richardsonii*, 4 ♂, 3 ♀ (L.G.S.)
Val Marie, 18.VIII.43, ex *C. richardsonii*, 1 ♂, 2 ♀ (A.P.Surv.); 18.IX.42, ex *Cynomys l. ludovicianus*, 2 ♂, 1 ♀ (W.F.)

Specimens examined: large series, of both sexes, including 7 ♂ and 11 ♀ topotypes.

OPISOCROSTIS SAUNDERSI (Jordan)

(Plate XXVII, figs. 209, 210; Map 26)

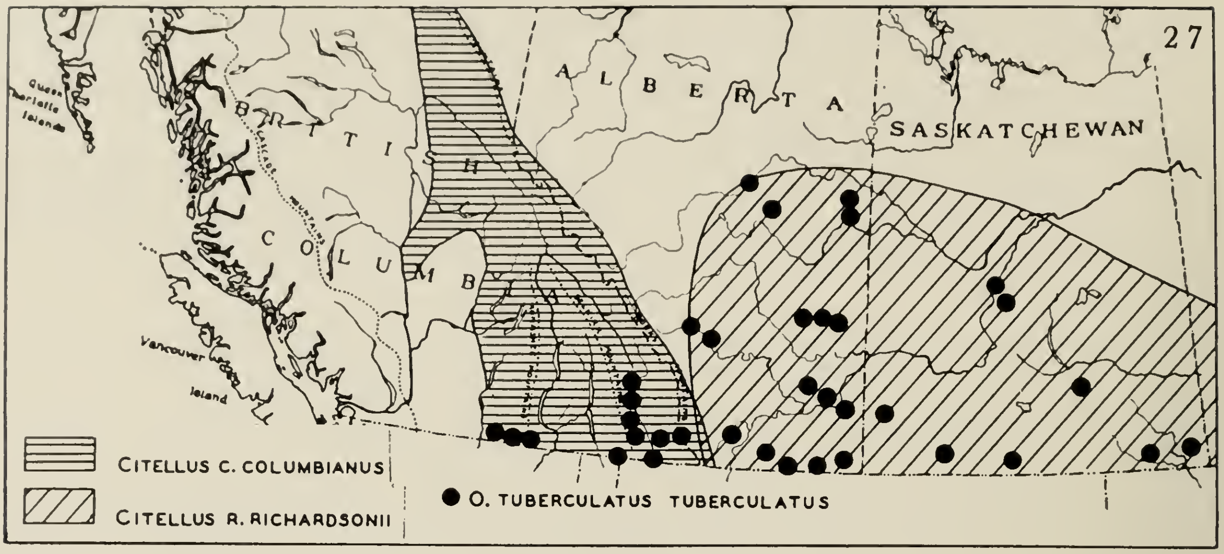
Ceratophyllus saundersi Jordan 1933. The Entomologist, 66:16-17; text-figs. 6,7. Both sexes from Saskatchewan (no specific locality mentioned), ex *Citellus richardsonii*. Author's note: according to Dr. L. G. Saunders, the original collector in a personal communication the locality was Saskatoon, Sask.

Opisocrostis saundersi (Jordan). Jordan 1933, Nov. Zool. 39:73.

This flea is apparently rare, or at least rare in the vicinity of its type locality. Dr. L. G. Saunders and W. Fuller of the University of Saskatchewan have submitted nearly 500 fleas from the type host and type locality, in a generous effort to furnish the writer with specimens of this species. All this collecting has yielded only three specimens of *O. saundersi*, all females.

The species is strikingly like *O. bruneri* in the form of the male genitalia and contour of sternum VII in the female, but differing as shown in the keys and illustrations. We have no new locality data. There is the possibility that "*saundersi*" was founded on aborted specimens of *bruneri* which also occurs in that vicinity.

Specimens examined: 3 ♀. Figure of male after Jordan.



MAP 27

Ceratophyllidae:Ceratophyllinae. Locality records of *Opisocrostis tuberculatus tuberculatus* (Baker), superimposed on the ranges of *Citellus c. columbianus* and *C. r. richardsonii*, modified after Howell 1938

OPISOCROSTIS TUBERCULATUS TUBERCULATUS (Baker)

(Plate XXVI, fig. 204; plate XXVII, figs. 211, 212; Map 27)

Ceratophyllus tuberculatus Baker 1904, U. S. Nat. Mus. Proc. 27:387,393,394,447; pl. XIII, figs. 7-9. Both sexes, from Moscow, Idaho, ex *Citellus columbianus*.

Opisocrostis tuberculatus (Baker). Jordan 1933, Nov. Zool. 39:73.

Opisocrostis tuberculatus tuberculatus (Baker). Jellison 1939, Pub. Hlth. Rept. 54:843; figs.

Opisocrostis tuberculatus (Baker). Holland 1940, Ent. Soc. B. C. Proc. 36:11. Recorded from Kimberley, B.C. and Waterton Lakes, Alberta, ex *Citellus columbianus columbianus*.

Oropsylla (*Opisocrostis*) *tuberculata tuberculata* (Baker). Brown 1944, Ent. Soc. Amer. Ann. 37:210. Recorded from the following localities in Alberta: Edmonton, Stanmore, Camrose, Youngstown, Manyberries and Brooks, ex *C. columbianus*, *C. richardsonii* and *Lepus* sp.

The true host of this flea is likely *Citellus richardsonii*, the transference to *C. columbianus* probably having occurred during historic times, being brought about by the tendency for *C. columbianus* to follow man's roads and railway grades, thus extending its range. In British Columbia the species is known only in the Osoyoos-Midway country, and the southern Kootenay district where a population of Columbian group squirrels, infested with these fleas, may be traced through the Crow's Nest Pass to the eastern foothills of Alberta, where both *columbianus* and *richardsonii* occur. See also discussion of *O. labis* and *Neopsylla inopina*.

A subspecies, *O. tuberculatus cynomuris* Jellison 1939 occurs on prairie-dogs in Montana, Wyoming and Colorado. While prairie-dogs occur in one small area of southern Saskatchewan, collections of fleas from them have revealed only typical *O. t. tuberculatus* as well as some other species. *O. ornatus* I. Fox 1940, from Colorado, is very close to, if not identical with *O. t. cynomuris*.

New Canadian records:

B.C.: Anarchist Mountain, 27.V.41, host not recorded, 1♂ (G.C.C.)
Canal Flats, 16.VII.40, ex *Citellus c. columbianus*, 1♂ (S.P.Crew)
Cascade, 4.VI.40, ex *C. columbianus*, 1♂ (S.P.Crew)
Cranbrook, 24.V.40, ex *C. columbianus*, 2♂, 4♀ (S.P.Crew)
Crow's Nest Pass, 16.V.40, ex *C. columbianus*, 2♂ (S.P.Crew)
Eholt, 15.VI.40, ex *C. columbianus*, 1♂, 1♀ (S.P.Crew)
Fernie, V.40, ex *C. columbianus*, 2♂, 9♀ (S.P.Crew)
Flagstone, 17.V.40, ex *C. columbianus*, 2♂, 1♀ (S.P.Crew)
Fort Steele, 30.IV.40, ex *C. columbianus*, 5♂, 7♀ (S.P.Crew)
Galloway, 7.V.40, ex *C. columbianus*, 2♂, 1♀ (S.P.Crew)
Grand Forks, 17.VI.40, ex *C. columbianus*, 2♂, 1♀ (S.P.Crew)
Greenwood, 19.VI.40, ex *C. columbianus*, 1♀ (S.P.Crew)
Newgate, 8.VII.40, ex *C. columbianus*, 1♂ (S.P.Crew)

Rock Creek, 23.VI.40, ex *C. columbianus*, 1♂, 1♀ (S.P.Crew)
Roosville, 14.V.40, ex *C. columbianus*, 1♂, 1♀ (S.P.Crew)
Windermere, 27.IV.40, ex *C. columbianus*, 1♂ (S.P.Crew)
Yahk, 24.VI.40, ex *C. columbianus*, 2♂, 2♀ (S.P.Crew)

Alta.: Aden, 13.VI.40, ex *Citellus r. richardsonii*, 1♂ (G.P.H.)
Blairmore, 14.VII.45, ex *C. columbianus*, 3♂ (S.P.Crew)
Brooks, 7.VI.40, ex *C. richardsonii*, 1♂, 1♀ (S.P.Crew)
Calgary, 28.VI.40, ex *C. richardsonii*, 3♂, 1♀ (G.P.H.)
Delia, 31.V.40, ex *C. richardsonii*, 1♂, 1♀ (S.P.Crew)
Hanna, 12.V.43, ex *C. richardsonii*, 1♀ (A.P.Surv.)
MacLeod, 24.VII.40, ex *C. richardsonii*, 2♂ (S.P.Crew)
Medicine Hat, 9.VI.43, ex *C. richardsonii*, 2♀ (A.P.Surv.)
Milk River, 15.V.40, ex *C. richardsonii*, 1♀ (S.P.Crew)
Oldman Lake, 29.V.40, ex *C. richardsonii*, 2♂, 2♀ (S.P.Crew)
Oyen, 27.VI.44, ex *C. richardsonii*, 1♀ (S.P.Crew)
Scotfield, 21.VI.40, ex *C. richardsonii*, 1♂, 1♀ (S.P.Crew)
Suffield, 3.VII.43, ex *C. richardsonii*, 1♂ (S.P.Crew)
Three Hills, 30.VI.44, ex *C. richardsonii*, 1♀ (S.P.Crew)
Vermilion, VI.43, ex *C. richardsonii*, 6♂, 1♀ (A.P.Surv.)
Wainwright, 20.VI.43, ex *C. richardsonii*, 4♂ (A.P.Surv.)

Sask.: Big Beaver, 3.VIII.43, ex *C. r. richardsonii*, 1♀ (S.P.Surv.)
Dundurn, 25.V.43, ex *C. richardsonii*, 2♂, 1♀ (A.P.Surv.)
Estevan, VI.44, ex *C. richardsonii*, 1♂, 2♀ (W.F.)
Gainsborough, 7.VII.43, ex *Citellus 13-lineatus*, 1♂ (P.L.)
Maple Creek, 27.V.43, ex *C. richardsonii* (A.P.Surv.)
Regina, VI.43, ex *C. richardsonii*, 1♂, 3♀ (A.P.Surv.)
Rock Glen, 9.IX.42, ex *C. richardsonii*, 3♀ (W.F.)
Saskatoon, various dates, ex *C. richardsonii*, 30♂, 40♀ (L.G.S.) (W.F.); 25.IV.46, ex *Citellus 13-lineatus*, 1♂ (W.F.)
Val Marie, 1.VI.44, ex *Cynomys l. ludovicianus*, 1♀ (P.L.)

Specimens examined: large series, of both sexes, including the ♂ and ♀ types (U.S.N.M.)

OPISODASYS Jordan

Genotype: *Ceratophyllus vesperalis* Jordan 1929
Opisodasys Jordan 1933, Nov. Zool. 39:72.

Eye well developed. Clypeal tubercle small. Fore femur with but one lateral seta. Proximal pair of plantar bristles shifted ventrally.

Male claspers having moveable process armed with pigmented spiniforms which are directed downwards or distad. Sternum VIII narrow, with setae and membranous appendage. No spiniforms on ventral arm of sternum IX.

Females with anal sternum rounded ventrally, but not angulate. Stylet curved (Pl. XXVIII, fig. 219). Head of spermatheca longer than broad, and dorsally convex.

A nearctic genus containing nine species which are divisible into two groups on a number of characters including chaetotaxy of the head, structure of tergum VIII in the male, and host preference. Certain tree squirrels *(Glaucomys* and *Sciurus)* are the normal hosts of one group. The other occurs on mice *(Peromyscus)*.

Three species are known in Canada.

Key to the Canadian species of *Opisodasys*

1. Normally on *Peromyscus*.
Preantennal region strongly rounded, and bearing two rows of setae (Pl. XXVII, fig. 213)
♂. Tergum VIII with pointed apical process (fig. 214)
♀. Genitalia as in fig. 215 a-f . . . . *keeni*

Normally on *Glaucomys*.

Preantennal region not so strongly rounded and with but one complete row of setae (Pl. III, figs. 3,4)

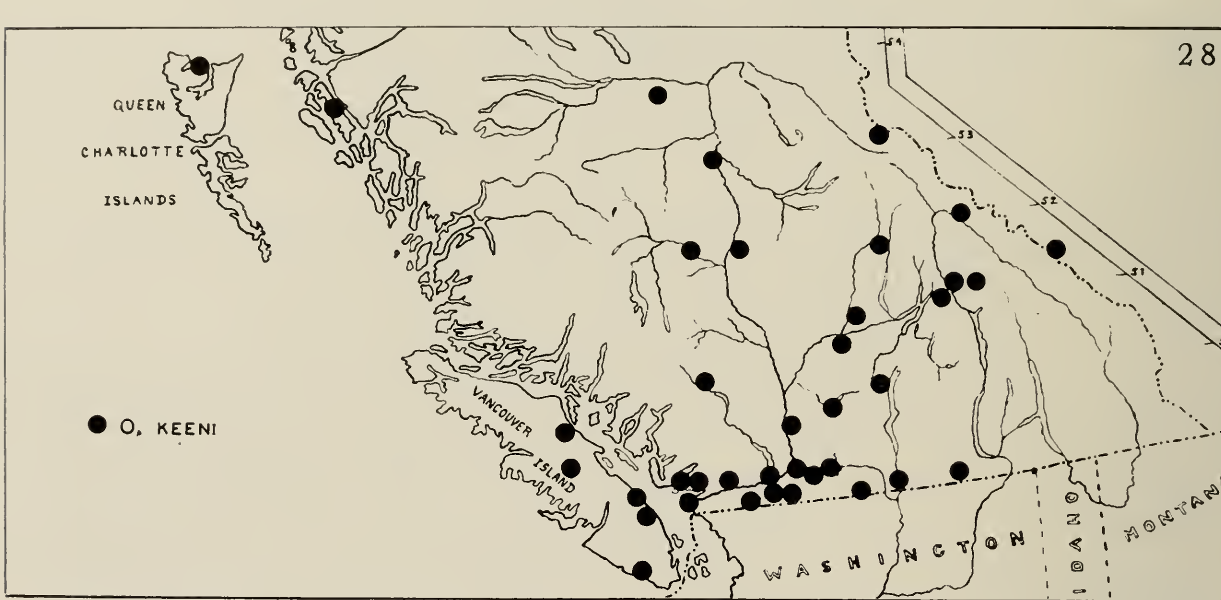
♂. Tergum VIII without conspicuous process, but with many posteroventral marginal setae (Pl. XXVIII, fig. 216) 2

2. ♂. F with one long curved spiniform above, and a long and a short one below (fig. 218)

♀. Sternum VII with pronounced lobe and sinus (fig. 220 a-g) . . . . *vesperalis*

♂. F with one long spiniform above, and two short ones below (fig. 216)

♀. Sternum VII not strongly lobed (fig. 217) . . . . *pseudarctomys*



MAP 28

Ceratophyllidae:Ceratophyllinae. Locality records of *Opisodasys keeni* (Baker).

OPISODASYS KEENI (Baker)

(Plate XXVII, figs. 213, 214, 215; Map 28)

Pulex keeni Baker 1896, Can. Ent. 28:234. Described from both sexes from Massett, Queen Charlotte Islands, B.C., ex "*Sitomys keeni*" (*Peromyscus maniculatus keeni*).

Ceratophyllus keeni (Baker). Baker 1904, U. S. Nat. Mus. Proc. 27:400,444; pl. XVI, figs. 7-12.

Opisodasys keeni (Baker). Jordan 1933, Nov. Zool. 39:72.

Opisodasys keeni. (Baker). Wagner 1936, Can. Ent. 68(9):198-199. Recorded from Vancouver and Aspen Grove, B.C. ex *Peromyscus maniculatus*.

Opisodasys keeni (Baker). Jellison 1939, Journ. Parasitol. 25(5):416; 3 figs.

Peromyscus appears to be the true host of this common flea, which we have from many localities in the southern half of British Columbia, including the islands off the coast. It is not known to occur east of the Rocky Mountains. Its range closely coincides with that of *Malaraeus telchinum* (Rothschild).

New Canadian records:

B.C.: Allison Pass, 28.VII.45, ex *Peromyscus m.* ssp., 3♂, 4♀ (G.C.C.); 28.VII.45, ex *Microtus* sp., 1♀ (G.C.C.)
Berg Lake, 26.VII.44, ex *Peromyscus m. borealis*, 2♂, 2♀ (G.P.H.)
Boston Bar, 6.VII.35, ex *Peromyscus* sp., 1♀ (J.D.G.)
Campbell River, V. I., 20.VIII.43, ex *Peromyscus* sp., 1♂ (H.D.F.)
Caulfield, 23.IV.42, ex *Peromyscus m. austerus*, 1♀ (J.D.G.)
Cawston, 24.V.45, ex *Peromyscus m. artemisiae*, 1♂, 5♀ (G.P.H.)
Chilliwack, 19.V.43, ex *Peromyscus*, 1♀ (J.D.G.)

Copper Creek, 8.V.42, ex *Peromyscus* sp., 7♂, 14♀ (G.P.H.)
Cultus Lake, 22.XI.40, ex weasel, 1♂ (D.L.)
Eagle Pass, 17.IV.43, ex *Peromyscus m. artemisiae*, 1♂, 4♀ (G.P.H.)
Ewing's Landing, 15.X.41, ex *Peromyscus m. artemisiae*, 1♀ (G.P.H.)
Forbidden Plateau, 24.VIII.43, ex *Peromyscus m. interdictus*, 2♀ (G.C.C.)
Gambier Is., 3.VII.39, ex *Peromyscus m. austerus*, 2♀ (G.P.H.)
Glacier, VIII.42, ex *Peromyscus* sp., 1♂, 3♀ (J.D.G.)
Gleneagles, 28.IV.40, ex *Peromyscus m. austerus*, 6♂, 6♀ (J.D.G.)
Harrison Bay, 8.IV.41, ex *Peromyscus m. austerus*, 5♂, 2♀ (J.D.G.)
Huntingdon, III.41, ex *Microtus o. serpens*, 1♀ (I.McT.C.); 28.II.43, ex *Microtus t. townsendii*, 1♀ (I.McT.C.)
Jordan River, V. I., 25.V.44, ex *Peromyscus* sp., 2♂ (H.D.F.)
Kamloops, various dates, ex *Peromyscus m. artemisiae*, 10♂, 10♀ (G.P.H.)
Kinbasket Lake, 4.VIII.42, ex *Peromyscus*, 4♂ (G.P.H.)
Manning Park, VIII.45, ex *Peromyscus m.* ssp., 8♂, 13♀ (G.C.C.)
Mariwood Lake, V.I., 1.IX.43, ex *Peromyscus m. interdictus*, 2♂, 4♀ (G.C.C.)
Mt. Revelstoke, 18.V.45, ex *Peromyscus m. alpinus*, 1♀ (G.P.H.)
Mt. Seymour, 27.VI.44, ex *Peromyscus m. oreas*, 1♂ (G.P.H.)
Nanaimo, V.I., 5.VIII.44, ex *Peromyscus* sp., 3♀ (H.D.F.)
Newcastle Island, 9.VI.44, ex *Peromyscus* sp., 2♂ (H.D.F.)
Nicola, 4.V.44, ex *Peromyscus m. artemisiae*, 3♂, 4♀ (G.P.H.)
Nulki Lake, V.45, ex *Peromyscus m.* ssp., 1♂ (J.A.M.)
Oliver, 24.V.45, ex *Peromyscus m. artemisiae*, 1♀ (G.P.H.)
Phoenix, ex *Peromyscus* sp., (J.B.P.)
Pitt Island, 6.VI.45, ex *Peromyscus* sp., 1♀ (H.D.F.)
Quesnel, 17.VIII.43, ex *Peromyscus m. borealis*, 1♂ (M.S.)
Rayleigh, 29.III.44, ex *Peromyscus m. artemisiae*, 1♂ (G.P.H.)
Redstone, 2.VI.41, ex *Peromyscus m. borealis*, 1♂ (F.M.S.)
Silver Creek, 31.V.41, ex *Peromyscus m. oreas*, 4♀ (J.D.G.)
Steelhead
Tenquille Lake, 30.VII.45, ex *Peromyscus m.* ssp. 2♂, 4♀ (G.P.H.); 30.VII.45, ex *Zapus* sp.; 30.VII.45, ex *Clethrionomys*, 1♀ (G.P.H.)
Timberline Valley, 5.VIII.45, ex *Peromyscus m.* ssp., 1♂, 4♀ (G.C.C.)
Tl-ell, Graham Is., Q.C.I., 12.III.35, ex *Peromyscus m. keeni*, 1♀ (J.A.M.)
Tranquille, 17.VII.33, ex *Peromyscus m. artemisiae*, 1♂ (D.C.)
Tulameen, 7.V.42, ex *Peromyscus* sp., 3♂, 6♀ (G.P.H.)
Vavenby, 9.IV.40, ex *Peromyscus* sp., 2♀ (J.D.G.)
Williams Lake, 7.IV.44, ex *Peromyscus* sp., 15♂, 53♀ (G.P.H.)
Yellow Point, XII.44, ex *Peromyscus* sp., 2♂, 3♀ (A.C.B.)

Alta.: Banff, 14.VII.39, ex *Peromyscus* sp., 1♀ (J.D.G.)

Specimens examined: large series, of both sexes, including the types, ♂ and ♀ (U. S. N. M.)

MAP 29

Ceratophyllidae:Ceratophyllinae. Locality records of the *Glaucomys*-infesting species of *Opisodasys*, *O. pseudarctomys* (Baker) and *O. vesperalis* (Jordan).

OPISODASYS PSEUDARCTOMYS (Baker)

(Plate XXVIII, figs. 216, 217; Map 29)

Ceratophyllus pseudarctomys Baker 1904, U. S. Nat. Mus. Proc. 27:387,399-400,446; pl. XXIV, figs. 1-7. Both sexes from Newport, New York, ex "*Arctomys monax*" (*Marmota monax*).

Ceratophyllus acasti Rothschild 1905, Nov. Zool. 12:168-170; pl. VII, figs. 19,20. Described from the female, from Quesnel, B.C., ex "*Sciuropterus sabrinus*" (*Glaucomys s.*). Synonym, fide Jordan, 1929.

Ceratophyllus pseudarctomys Baker. Jordan 1929, Nov. Zool. 35:28. Questions the locality record of "*acasti*" (assumption being that *pseudarctomys* does not occur west of the Rockies).

Opisodasys pseudarctomys (Baker). Jordan 1933, Nov. Zool. 39:72.

Opisodasys pseudarctomys (Baker). Jellison 1939, Journ. Parasitol. 25(5):415-416; 3 figs.

Opisodasys pseudarctomys (Baker). Holland 1941, Ent. Soc. B. C. Proc. 37:11-12. Recorded from Blackpool, B.C., ex *Glaucomys sabrinus alpinus*.

This species, a true parasite of flying squirrels *(Glaucomys)* is of widespread distribution, ranging from the Atlantic States to central British Columbia. Jordan (1929) doubted that this species occurred in British Columbia (where *O. vesperalis* also occurs), but as we have since taken it in this province on a number of occasions, the record of *acasti* from Quesnel is probably perfectly valid. Sometimes *O. pseudarctomys* and *O. vesperalis* are collected from the same individual animal.

New Canadian records:

B.C.: Chilcotin, III.41, ex *Tamiasciurus hudsonicus* ssp., 1 ♀ (G.P.H.)
Lac la Hache, 3.VII.42, ex *Glaucomys sabrinus columbiensis*, 1♂ (G.C.C.)
Kootenay National Park, 17.VI.43, ex *Clethrionomys gapperi* ssp., 1 ♀ (J.A.M.)
Rayleigh, 3.II.41, ex nest of *Tamiasciurus h. streatori*, 1♂ (G.P.H.)

Alta.: Red Deer, 14.XI.41, ex *Glaucomys sabrinus* ssp., 5♂, 4 ♀ (C.N.S.)

Ont.: Algoma, VIII.35, ex *Glaucomys sabrinus macrotis*, 36♂, 63 ♀ (C.H.D.C.); 16.VIII.35, *Tamiasciurus h. hudsonicus*, 1 ♀ (C.H.D.C.)
Charlton, 18.VII.34, ex *Tamiasciurus hudsonicus* ssp., 2 ♀ (E.D.)
Smoky Falls, Kapuscasing, 23.XI.37, ex *Glaucomys sabrinus* ssp., 2♂, 1 ♀ (R.V.W.)
Still River, ex *Glaucomys*, 1♂, 14 ♀.

Specimens examined: 56♂, 95 ♀, including the type ♂ (U. S. N. M.)

OPISODASYS VESPERALIS (Jordan)

(Plate III, figs. 3, 4; plate XXVIII, figs. 218, 219, 220 a-g; Map 29)

Ceratophyllus vesperalis Jordan 1929, Nov. Zool. 35:28; pl. 1, figs. 1, 2. Described from both sexes, taken at Okanagan and Okanagan Landing, B.C., ex "*Sciuropterus alpinus*" (*Glaucomys sabrinus columbiensis*).

Opisodasys vesperalis (Jordan). Jordan 1933, Nov. Zool. 39:72.

Opisodasys vesperalis (Jordan). Jellison 1939, Journ. Parasitol. 25(5):415; 3 figs.

Opisodasys pseudarctomys (Baker). Wagner 1940, Zeitsch. f. Parasitenk. 11(4):463. Recorded from Loughboro Inlet, B.C., ex "*Glaucomys sabrinus alpinus*" (*G. s. oregonensis*). This was a *lapsus calami* on the part of Dr. Wagner. The writer has examined the specimens from which he established this record, and they are *vesperalis*. As there were males present, this identification is positive.

Opisodasys vesperalis (Jordan). Holland 1941, Ent. Soc. B. C. Proc. 37:12. Recorded from British Columbia as follows: Grey Creek, Paul Lake, Loughboro Inlet, and Tetana Lake, without host data. Records repeated in detail below.

Opisodasys jellisoni Fox 1941, Ent. News 52(2):45-47; figs. 1-3. Described from Boise, Idaho, ex *Glaucomys sabrinus bangsii*. The author examined the types of this species at the United States National Museum, Washington, D.C., and found the male to be *Tarsopsylla coloradensis* (Baker). The female is *Opisodasys* sp., and shows no character whereby it may be distinguished from *vesperalis*. As the known range of *vesperalis* flanks Idaho east and west, having been reported from Montana and Oregon, there is no reason to regard this specimen as possibly distinct. New synonymy (in part).

This species, like *O. pseudarctomys* is a true parasite of *Glaucomys*. In Canada it appears to be confined to central and coastal British Columbia. The males are unmistakable, and the females too may be distinguished from those of *pseudarctomys* by the shape of the spermatheca and the characteristic (though variable) incision of sternum VII.

New Canadian records:

B.C.: Alta Lake, 4.IX.44, ex *Glaucomys sabrinus fulginosus*, 1♂, 1 ♀ (I.McT.C.)
Bear Lake, 1.II.38, ex *Glaucomys s. alpinus*, 1 ♀ (J.F.S.F.)
Grey Creek, III.40, ex "weasel", 1♂ (G.O.); III.40, ex *Lynx canadensis*, 1 ♀ (G.O.)
Kamloops (Paul Lake), 23.III.38, ex *Glaucomys sabrinus* ssp., 5♂, 10 ♀ (G.P.H.)
Lac la Hache, 3.VII.42, ex *Glaucomys s. columbiensis*, 6♂, 9 ♀ (G.C.C.)

Manning Park, 12.VIII.45, ex *Glaucomys s.* ssp., 1♂ (G.C.C.)
Tenquille Lake, 1.VIII.45, ex *Glaucomys s. fulginosus*, 3♂, 6♀ (G.P.H.)
Tetana Lake, 11.V.38, ex *Glaucomys s. alpinus*, 1♂ (J.F.S.F.)
Trinity Valley, 8.VIII.46, ex *Glaucomys s. columbiensis*, 2♂, 4♀ (D.K.C.)
Vancouver, 24.IX.44, ex *Glaucomys s.* ssp., 2♀ (H.D.F.)

Specimens examined: 25♂, 40♀, including a ♂ paratype (U. S. N. M.)

ORCHOPEAS Jordan

Genotype: *Pulex howardii* Baker 1895.
Bakerella Wagner 1930, Magazin de Parasitol. 1:101,119.
Orchopeas Jordan 1933, Nov. Zool. 39:71.
Orchopeas Jordan. Wagner 1936, Can. Ent. 68(9):199. = *Bakerella* Wagner, preoccupied.

Related to *Opisodasys* in having fore femur with but one lateral seta, proximal pair of plantar bristles on all tarsi V and many other details as in that genus but differing in the modified segments of both sexes.

Males with sternum VIII narrow, without setae, but with an apical membranous flap of various forms. Proximal lobe of ventral arm of sternum IX with conspicuous spiniform. Moveable process of claspers ham-shaped, being narrowest at the base, and armed on the posterior margin with 4-6 short, pointed, sub-equal spiniforms, which are directed upwards. Above these, on the apical margin of F, a long seta.

Females with stylet not noticeably curved. Ventral margin of anal sternum distinctly angulate near middle (Plate XXVIII, fig. 222). Head of spermatheca barrel shaped, longer than broad. Tail of spermatheca with apical process.

A strictly nearctic genus, containing seven or eight species, the status of one or two of which is in doubt. Most of these fleas infest tree squirrels (*Tamiasciurus* and *Sciurus)* but one species regularly infests mice (especially *Peromyscus*) and another is a true parasite of woodrats *(Neotoma).* This last exists as a number of recognizable subspecies.

While the males, although of much the same general plan, are readily determined (with the exception of the subspecies of *O. caedens*), the females are sometimes difficult to identify with certainty, as they are much alike in some cases, and also as they tend to vary, especially with reference to sternum VII. Typical examples of the six species and subspecies known from Canada may be separated by the following key:

Key to the Canadian species and subspecies of *Orchopeas*

1. Ocular and frontal rows of setae complete (Pl. XXIX, fig. 226) 2
   Only ocular row complete. Frontal row normally represented only by a single long seta (fig. 225) 3
2. Labial palpus not reaching apex of fore coxa. Normally parasitizing mice . . . . *leucopus*
   Labial palpus as long as fore coxa. On woodrats (*Neotoma*) . . . . *sexdentatus agilis*
3. Known only from southwest British Columbia; west of the Cascades; normally on *Tamiascurus douglassi* . . . . *nepos*
   East of the Cascades, on other species of squirrels 4
4. Normally on *Sciurus carolinensis*
   ♂. F and P approximately equal (fig. 233)
   ♀. Sinus on sternum VII small, deep, and situated low down (fig. 234) . . . . *howardii*
   Normally on *Tamiasciurus hudsonicus*
   ♂. F exceeding P (fig. 221)
   ♀. Sinus on sternum VII of variable form (figs. 223-224) but not as above . . . . *caedens* ssp. — 5
5. Note: Males of the subspecies of *caedens* appear to be impossible to separate on morphological characters — see text.
   ♀. Upper lobe of sternum VII acutely to obtusely pointed; shorter than lower lobe. Lower lobe with conspicuous longitudinal ridge (fig. 223-a-h) . . . . *caedens caedens*
   Sternum VII incised or entire. When incised, upper lobe is usually bluntly rounded; longer than lower. No ridge on inside of lower lobe (fig. 224 a-i) . . . . *caedens durus*

MAP 30
Ceratophyllidae:Ceratophyllinae. Locality records of the squirrel-infesting species of *Orchopeas*, *O. caedens caedens* (Jordan), *O. caedens durus* (Jordan), *O. nepos* (Rothschild) and *O. howardii* (Baker), superimposed on the ranges of *Tamiasciurus hudsonicus* ssp., *T. douglassi mollipilosus*, and *Sciurus carolinensis* ssp., as outlined by I. McT. Cowan and A. L. Rand.

ORCHOPEAS CAEDENS CAEDENS (Jordan)

(Plate XXVIII, figs. 221, 222; plate XXIX, figs. 223, 225; Map 30)

Ceratophyllus caedens Jordan 1925, Nov. Zool. 32:104-105; text-figs. 16,17. Both sexes from Banff, Alta., ex "*Mustela americana*" (*Martes a.*).
Ceratophyllus caedens caedens Jordan. Jordan 1929, Nov. Zool. 35:29-30.
Orchopeas caedens (Jordan). Jordan 1933, Nov. Zool. 39:71-72.
Orchopeas caedens (Jordan). I. Fox 1940, Fleas of Eastern U. S.; 62-63; pl. XVI, figs. 80,81,82.
Orchopeas caedens (Jordan). Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:33.

In describing *Orchopeas* (then *Ceratophyllus*) *caedens durus*, (which see) Dr. K. Jordan remarked that all the Alberta material in the Tring collection belonging to *caedens caedens* and all the British Columbia specimens to *caedens durus*, the two subspecies being separated principally on the character of sternum VII in the female, which in the former was stated to be divided into a short upper lobe and a broader and somewhat longer lower one, the latter bearing a conspicuous longitudinal ridge on the inner side, whereas in *durus*, sternum VII varied from being entire to incision into two long lobes, but always lacked the ridge.

Wagner (1936:199) expressed doubt that *O. caedens* existed as two separate races in the adjoining provinces of British Columbia and Alberta suggesting that "possibly we have to do here not with races, but with simple non-geographical variations". These words of Wagner were expressed as an opinion only, and were evidently not the result of a study of specimens. Irving Fox (1940:62) and Ewing and Fox (1943:33) followed Wagner's suggestion and listed *durus* as a synonym, apparently without studying specimens. The latter also cite a record of *O. caedens durus* from Labrador (Eidmann 1935:100) the specimens of which were determined by Jordan—the inference being that such a record would not be probable for a geographical subspecies previously recorded only

from British Columbia. Jellison (1940:335) questioned Fox's reduction of *durus* to synonymy on the basis of study of specimens in the Rocky Mountain Laboratory, Montana.

Study of a fairly extensive series of these fleas (which are common parasites of the red squirrel, *Tamiasciurus hudsonicus*) from widely scattered Canadian localities, plus specimens from Alaska, Yukon and the United States, loaned by Wm. L. Jellison, and others from Labrador, the eastern United States and parts of Canada, loaned by Dr. Jordan, have led the writer to believe that Wagner and his followers are in error, and that the two subspecies should be recognized as distinct.

Unfortunately there do not seem to be any reliable characters separating the males, but this is not new in the study of geographical subspecies of fleas (*Monopsyllus w. wagneri* and *M. w. systaltus*, for example, have reliable distinctions evident only in the females). Jordan mentions in his diagnosis of *durus* that the "expodite" of the male usually bears four spiniforms whereas in *caedens caedens* there are usually five, with intermediate arrangements of four on one and five on the other being rare in either subspecies. This statement does not hold true in the light of the present study, nearly all of our males bearing four spiniforms on either side, any other arrangement being rare.

However, in the females, we do find an almost perfectly constant situation in sternum VII, which character alone, in view of the association with geographical distribution, appears to warrant subspecific distinction.

Orchopeas caedens caedens has, as stated, sternum VII on each side divided into lobes of which the upper is short and acutely to obtusely pointed (see plate XXIX figs. 223 a-h, illustrating a series from Fort Liard, N.W.T.) and the lower, longer, and with a conspicuous sclerified ridge as shown. Very rarely a female will have an extremely short lobe and sinus, and lack the ridge, but in over one hundred examined, only six were like this, and all these were from the north in territory near the range of *durus*. Some females from Park Co., Colorado, are typical *caedens*.

Orchopeas caedens durus has sternum VII extremely variable and ranging from deep incision to entirety, but typically with the upper lobe squarish or broadly rounded and longer than the lower (see fig. 224 a-i, a series from Quesnel, B.C.). The sclerified ridge, so typical of *caedens*, is lacking, but a very few had on the lower lobe a slightly darkened area caused by the running together of some of the contour-like surface markings of the sclerite.

From the information at hand (see map 30) it appears that *O. c. caedens* occupies most of Alberta, Saskatchewan, northern British Columbia and the southern part at least of Yukon and District of Mackenzie. *Orchopeas c. durus* is common in the southern interior of British Columbia, ranges northward fairly close to the coast, occurs in coastal Alaska, extends across the Northwest Territories, meeting *caedens caedens* near Great Slave Lake, cuts through northern Saskatchewan, and occupies Manitoba, Ontario, Quebec, Labrador, the Maritimes, and eastern United States. In the southern part of British Columbia, *durus* and *caedens* are separated by the Rocky Mountains, but at Banff (unfortunately the type locality of *caedens caedens*) both forms occur, and at Kinbasket Lake and a few other localities, we have *caedens* turning up sometimes on the same animal as *durus*. A small series from Atlin, B.C., and another from Blanchet Island, Great Slave Lake, contain both *caedens* and *durus*. These localities appear to be part of an intermediate area separating pure populations of the two subspecies. A hypothetical line of separation is shown on map 30.

O. labiatus (Baker 1904), described from a single female, may prove to be a prior name. I. Fox (1940:67; pl. IX, fig. 7) gave notes on this specimen and illustrated sternum VII which has a deep lobe and sinus. Dr. Jordan sent the writer a drawing of the spermatheca, which has a very globular head. A series

of 21 females from Moscow Mountains, Idaho (near type locality of "*labiatus*") loaned by Wm. L. Jellison shows variable lobar development on sternum VII, although most of the specimens in this series have this sclerite more or less entire, and none is incised like Fox's drawing. Also the shape of the spermatheca is variable, although in none did it approach the extreme globular shape of that organ in Baker's type.

New Canadian records:

B.C.: *Atlin, ex *Tamiasciurus hudsonicus* ssp., 2 ♀ (H.S.)
*Beavermouth, II.41, ex "weasel", 1 ♀ (P.B.)
*Chilcotin, III.41, ex *Tamiasciurus hudsonicus* ssp., 1 ♀ (G.P.H.)
*Kinbasket Lake, 4.VIII.43, ex *T. hudsonicus* ssp., 1 ♀ (G.P.H.)
Lempriere, 11.VIII.44, ex "squirrels", 4 ♂, 3 ♀ (intergrades ?) (O.F.)

Alta.: Blackfalds, 23.VI.40, ex *T. hudsonicus preblei*, 9 ♂, 18 ♀ (G.P.H.)
Chipewyan, 27.VII.45, ex *T. hudsonicus* ssp., 14 ♂, 24 ♀ (W.F.)
Red Deer, ex *Tamiasciurus* sp., 1 ♀ (A.D.G.)

Sask.: Carlyle Lake, 23.VI.44, ex *T. hudsonicus* ssp., 1 ♂, 2 ♀ (W.F.)
Emma Lake, 5.VI.40, ex *Citellus franklinii*, 1 ♂, 1 ♀ (L.G.S.)

N.W.T.: *Blanchet Island, Great Slave Lake, 7.VIII.46, ex *T. hudsonicus* ssp., 1 ♀ (W.F.)
Liard, I.45, ex "red squirrel", 6 ♂, 22 ♀ (R.C.M.P.)
*Pearson Point, Great Slave Lake, 20.VIII.46, ex *T. hudsonicus* ssp., 1 ♀ (W.F.)
Rae, 17.III.45, ex *T. hudsonicus* ssp., 1 ♂, 7 ♀ (R.C.M.P.)
Reliance, X.34, ex *T. hudsonicus* ssp., 2 ♂, 5 ♀ (R.C.M.P.); 25.XI.34, ex *Vulpes fulva* ssp., 1 ♂, 1 ♀ (R.C.M.P.); 1.XII.34, ex *Mustela vison* ssp., 4 ♂ (R.C.M.P.)
Wood Buffalo Park, 18.III.33, ex *T. hudsonicus preblei*, 6 ♀ (J.D.S.)

Y.T.: Lake Bennett, 3 ♂, 3 ♀

Specimens examined: 50 ♂, 110 ♀.

ORCHOPEAS CAEDENS DURUS (Jordan)

(Plate XXIX, fig. 224 a-i; Map 30)

Ceratophyllus caedens durus Jordan 1929, Nov. Zool. 35:29-30; pl. I, fig. 3 a-g. Female (type) from Okanagan, ex "*Putorius arizonensis*" (*Mustela frenata* ssp.) and both sexes from Blucher Hall, ex "*Sciurus richardsonii*" (*Tamiasciurus hudsonicus streatori*) Mara Lake, ex "*Sciurus hudsonicus*" (*Tamiasciurus h.*), Kelowna, ex *Mustela* and other localities in British Columbia.

Ceratophyllus caedens durus Jordan. Jordan 1932, Nov. Zool. 38:253. Recorded from Atlin, B.C., ex "*Sciurus hudsonicus*".

Orchopeas (*Bakerella*) *caedens durus* (Jordan). Spencer 1936, Ent. Soc. B. C. Proc. 32:13. Recorded from weasel, and red squirrel, localities not named.

Orchopeas caedens durus (Jordan). Wagner 1936, Can. Ent. 68(9):199. Recorded "from different localities in B.C.", ex "*Sciurus hudsonicus streatori*" (*Tamiasciurus h. s.*), *Eutamias amoenus* and "*Mustela suturata*" (*M. frenata nevadensis*). He also records a female from "*Sciurus douglassi cascadensis*" (*Tamiasciurus d. mollipilosus*), no locality mentioned. There is a possibility of erroneous determination here, as in our experience, the Douglas squirrel is outside of the normal range of this flea.

The status of this subspecies is discussed under *Orchopeas caedens caedens*, which see.

New Canadian records:

B.C.: Allison Pass, 30.VII.43, ex *T. hudsonicus* ssp., 2 ♀ (G.C.C.)
Bear Lake, III.35, ex *Glaucomys s. alpinus*, 1 ♀ (J.F.S.F.)
†Beavermouth, II.41, ex "weasel", 1 ♀ (P.B.)
Black Pines, 4.VII.29, ex *Eutamias amoenus* ssp., 1 ♀ (E.H.)
Brilliant, 22.VIII.44, ex *Tamiasciurus hudsonicus* ssp., 1 ♀ (G.P.H.)
†Chilcotin, III.41, ex *T. h. hudsonicus*, 1 ♀ (G.P.H.)
Clearwater, 8.X.37, ex *T. hudsonicus* ssp., 1 ♀ (G.P.H.)
Copper Creek, 9.V.42, ex *T. hudsonicus* ssp., 1 ♀ (G.P.H.)
Cranbrook, 23.VIII.44, ex *T. hudsonicus* ssp., 2 ♀ (G.C.C.)
Deadman Creek, VIII.33, ex *T. hudsonicus* ssp., 5 ♀ (D.C.)
Dempsey Lake, 12.VIII.34, ex *T. hudsonicus* ssp., 3 ♀
Driftwood Valley, IX.34, ex *Eutamias minimus caniceps*, 1 ♀ (J.F.S.F.)
Ewing's Landing, 18.X.46, ex nest of *T. h. streatori*, 53 ♂, 50 ♀ (W.H.)
Grey Creek, III.40, ex "weasel", 1 ♂ (G.O.); III.40, ex *Lynx c. canadensis*, 1 ♂ (G.O.)
Hanceville, 27.III.41, ex nest of *T. h. hudsonicus*, 3 ♂, 9 ♀ (G.P.H.)
Kamloops, various dates, ex *T. h. streatori*, 100 (plus) ♂, 100 (plus) ♀; also ex *Mustela frenata* ssp., and *Glaucomys sabrinus* ssp.
†Kinbasket Lake, 4.VIII.43, ex *Tamiasciurus h.* ssp., 1 ♀ (G.P.H.)
Lac la Hache, 3.VII.42, ex *Glaucomys s. columbiensis*, 2 ♂, 3 ♀ (G.C.C.); 4.VII.42, ex *T. hudsonicus columbiensis*, 7 ♂ (G.C.C.); 12.X.46, ex nest of *T. h. columbiensis*, 23 ♂, 46 ♀ (G.P.H.)
Lac le Juene, 27.VII.34, ex *T. h. streatori*, 5 ♀ (T.K.M.)
Manning Park, 26.VII.45, ex *Tamiasciurus* sp., 2 ♂, 3 ♀ (G.C.C.)

* Records also of *Orchopeas caedens durus* (see).
† Records also of *Orchopeas caedens caedens* (see).

Monte Creek, 7.VII.29, ex *T. hudsonicus* ssp., 2♂, 3♀ (I.McT.C.)
Nicola, VI.33, ex *T. h. streatori*, 3♀ (G.J.S.); 1.X.32, ex *Mustela frenata nevadensis*, 1♀ (G.J.S.)
Nulki Lake, V.45, ex *T. hudsonicus* ssp., 1♂, 2♀ (J.A.M.)
Paradise Mine, 27.VIII.44, ex *T. hudsonicus streatori*, 3♀ (G.P.H.)
Pass Lake, VIII.33, ex *T. h. streatori*, 3♂, 12♀
Paxton Valley, 15.VIII.31, ex *T. hudsonicus* ssp., 1♀ (E.H.)
Puntchesakut, 12.V.44, ex *T. hudsonicus* ssp., 1♂ (J.A.M.)
Quesnel, 22.VIII.43, ex *T. hudsonicus* ssp., 3♂, 9♀ (M.S.)
Quick, 25.XI.44, ex *T. hudsonicus* ssp., 6♂, 9♀
Quilchena, 10.VII.35, ex *T. h. streatori*, 1♂ (J.D.G.)
Rayleigh, 27.IX.40, ex nest of *T. h. streatori*, 12♂, 25♀ (G.P.H.)
Redstone, 28.III.41, ex *T. h. hudsonicus*, 5♀ (G.P.H.)
Riske Creek, 29.VII.43, ex *T. h. hudsonicus*, 5♂, 2♀ (G.P.H.
Shumway Lake, 28.I.41, ex nest of *T. hudsonicus streatori*, 24♀ (G.P.H.)
Sorrento, 9.VIII.38, ex nest of squirrel, 1♂ (G.P.H.)
Springhouse, 11.X.46, ex nest of *T. hudsonicus* ssp., 2♂, 8♀ (G.P.H.)
Takla Lake, IX.34, ex *Eutamias*, 1♀ (J.F.S.F.)
Tatla Lake, 28.III.41, ex *T. h. hudsonicus*, 1♂ (G.P.H.)
Tranquille, 20.VII.34, ex *T. h. streatori*, 3♀ (D.C.); 20.VII.34, ex *Mustela* sp., 1♀ (D.C.)
Vavenby, various dates, ex *T. hudsonicus* ssp., (T.K.M.)

Alta.: †Banff, 15.IX.15, ex *M. americana*, 1♀ (from type locality of *c. caedens*, but this specimen resembles *durus*).

Man.: N. Reindeer Lake, 4.XII.44, 1♀

Ont.: Bell's Corners, 25.II.39, ex *Mustela erminea* ssp., 2♂, 6♀ (T.N.F.)
Charlton, 13.VII.35, ex *T. hudsonicus* ssp., 2♀ (E.D.)
Frank's Bay, 18.VI.32, ex *T. hudsonicus* ssp., 2♀
Kapuscasing, 3.IV.36, ex *T. hudsonicus* ssp., 2♀ (R.V.W.)
Pancake Bay, Algoma, VIII.35, ex *T. h. hudsonicus*, 20♂, 41♀ (C.H.D.C.); 8.VIII.35, ex *Mephitis m. mephitis*, 1♀ (C.H.D.C.)

N.B.: 4♂, 2♀ (J.B.)

N.W.T.: †Blanchet Island, Great Slave Lake, 7.VIII.46, ex *T. hudsonicus* ssp., 1♀ (W.F.)
†Pearson Point, Great Slave Lake, 20.VIII.46, ex *T. hudsonicus* ssp., 9♀ (W.F.)
Snowdrift, 18.VIII.46, ex *T. hudsonicus* ssp., 1♀ (W.F.) Also, 3♀ from Adirondack Lodge, Essex Co., N.Y., and 1♂, 4♀ from Metamek R., South Labroador ex *Mustela erminea* and *Tamiasciurus hudsonicus* tally closely with *durus*.

Specimens examined: large series, of both sexes.

MAP 31

Ceratophyllidae:Ceratophyllinae. Locality records of the Cricetid-infesting species of *Orchopeas*, *O. sexdentatus agilis* (Rothschild), (superimposed on the range of woodrats, *Neotoma cinerea* ssp., modified after Goldman 1910, by I. McT. Cowan), and *O. leucopus* (Baker).

† Records also of *O. caedens caedens* (see).

ORCHOPEAS LEUCOPUS (Baker)

(Plate XXIX, figs. 227, 228; Map 31)

Ceratophyllus leucopus Baker 1904, U. S. Nat. Mus. Proc. 27:387,401,444. Female from Peterboro, New York, ex *Peromyscus leucopus*.

Ceratophyllus aeger Rothschild 1905, Nov. Zool. 12:166-167; pl. VI, figs. 5,7,9. Both sexes from Red Deer, Alta., ex "*Peromyscus arcticus*" (*P. maniculatus borealis*) and "*Evotomys saturatus*" (*Clethrionomys gapperi loringi*). Synonym, fide Jordan 1929.

Ceratophyllus leucopus (Baker). Jordan 1929, Nov. Zool. 35:28-29.

Orchopeas leucopus (Baker). Jordan 1933, Nov. Zool. 39:72.

Orchopeas leucopus (Baker). I. Fox 1940, Fleas of Eastern U. S. 64-67; pl. XV, figs. 74-78.

Orchopeas leucopus (Baker). Jameson 1943, Journ. Mammal. 24(2):196. Recorded from Welland Co., Ontario, ex *Peromyscus leucopus noveboracensis*.

O. leucopus is the only member of the genus that regularly parasitizes mice, although another species, *O. 6-dentatus* occurs on *Neotoma*, another genus of Cricetidae. These two species are distinguished from other members of the genus (all of which infest squirrels) by the presence of two complete rows of setae on the preantennal region of the head. *O. leucopus* is further distinguished by the relative shortness of the mouth parts, the labial palpus seldom, if ever reaching the apex of the fore coxa, and by the structure of the genitalia. The shape of the moveable process of the male claspers recalls *O. caedens*, but the small size, and characteristic shape of the immoveable process (fig. 227), readily identifies *leucopus*. The sinus of sternum VII in the female is situated low down and is less variable in a series of specimens than is usual in the genus.

O. leucopus is the dominant flea of *Peromyscus* in eastern North America and occurs also in the Northwest Territories (see map 31). It is rare in southern British Columbia, but probably occurs fairly commonly from about Prince George northwards.

New Canadian records:

B.C.: Aleza Lake, 8.VIII.43, ex *Peromyscus m. borealis*, 4♂, 5♀ (L.C.C.)
Berg Lake, 28.VII.44, ex *Peromyscus m. borealis*, 1♀ (G.P.H.)
Tetana Lake, 6.IX.41, ex "mouse", 1♀ (J.F.S.F.)

Alta.: Blackfalds, 22.VI.40, ex *Peromyscus m. borealis*, 2♂ (G.P.H.)
Chipewyan, 12.VI.45, ex *Peromyscus m. borealis*, 2♂, 6♀ (W.F.)
Lethbridge, 10.VI.40, ex *Peromyscus m. osgoodi*, 4♂, 5♀ (G.P.H.)

Sask.: Carlyle Lake, 23.VI.44, ex *Peromyscus m.* ssp., 1♀ (W.F.); 23.VI.44, ex *Clethrionomys g. gapperi*, 2♀ (W.F.)
Crackingstone Point, 12.VIII.45, ex *Peromyscus m. borealis*, 5♂, 17♀ (W.F.)
Fond du Lac, 16.VII.45, ex *Peromyscus m. borealis*, 3♀ (W.F.)

Man.: Aweme, 7.IV.16, ex *Peromyscus m. bairdi*, 1♂, 2♀ (N.C.)
(These specimens labeled "*Ceratophyllus nepos*" by N. C. Rothschild!)

Ont.: Algoma (Pancake Bay) various dates, ex *Peromyscus m. gracilis*, 30♂, 56♀ (C.H.D.C.); 3.VIII.35, ex *Clethrionomys g. gapperi*, 1♀ (C.H.D.C.); 3.VIII.35, ex *Microtus c. chrotorrhinus*, 1♂ (C.H.D.C.): VIII.35, ex *Glaucomys s. macrotis*, 4♂ (C.H.D.C.); 6.IX.35, ex *Ondatra z. zibethica*, 1♀ (C.H.D.C.)
Algonquin Park (Long Lake, Biggar Lake, Brule Lake, etc.) 27.VII.34, ex *Blarina brevicauda talpoides* (C.H.D.C.); various dates, ex *Peromyscus* sp., 16♂, 21♀.
Chatham, 2.IV.41, ex *Microtus p. pennsylvanicus*, 1♂, 1♀ (G.M.S.); 11.IV.41, ex *Peromyscus leucopus noveboracensis*, 2♀ (G.M.S.)
Kawene, VII.45, ex *Peromyscus* sp., 6♂, 15♀ (A.C.B.); VIII. 45, ex *Microtus* sp., 1♀ (A.C.B.); VIII.45, ex *Tamias striatus* ssp., 1♂ (A.C.B.); VII.45, ex *Clethrionomys gapperi* ssp., 3♂, 6♀ (A.C.B.)
Smoky Falls, X.36, ex *Mus musculus*, 2♂, 4♀ (R.V.W.); ex *Peromyscus*, 1♂ (R.V.W.)

Que.: Abbotsford, 18.V.37, under Maple bark, 3♂, 2♀ (G.S.)

Y.T.: 104 miles N. of Fort Nelson, B.C., ex *Microtus pennsylvanicus*, 1♀ (A.L.R.)
213 miles N. of Fort Nelson, B.C., ex *Peromyscus m.* ssp., 1♀ (A.L.R.)

N.W.T.: Great Slave Lake, 20.VIII.44, ex *Peromyscus*, 3♂, 7♀ (P.L.)
Gros Cap, 28.VI.46, ex *Peromyscus*, 4♀ (W.F.)
Pearson Point, Great Slave Lake, 18.VII.46, ex *Peromyscus* sp., 1♀ (W.F.)
Reliance, VIII.44, ex *Peromyscus* sp., 2♂, 4♀ (P.L.)
Wildbread Bay, Great Slave Lake, 21.VIII.46, ex *Peromyscus* sp., 1♂, 10♀ (W.F.)
Yellowknife, 19.VII.44, ex *Peromyscus* sp., 3♂, 3♀ (P.L.)

Specimens examined: large series, of both sexes, including the type ♀ (U. S. N. M.)

ORCHOPEAS NEPOS (Rothschild)

(Plate XXIX, figs. 229, 230; Map 30)

Ceratophyllus nepos Rothschild 1905, Nov. Zool. 12.168; pl. VII figs. 13,14. Both sexes from Chilliwack, B.C., ex "*Spilogale latifrons*" (*S. gracilis olympica*).

Orchopeas nepos (Rothschild). Jordan 1933, Nov. Zool. 39:72.

Orchopeas nepos (Rothschild). Wagner 1936, Can. Ent. 68(9):199. Recorded from Abbotsford, B.C., ex "*Sciurus* sp." (*Tamiasciurus douglassi mollipilosus*).

This flea appears to be a true parasite of the Douglas chickaree (*T. douglassi* ssp.) and is confined to territory occupied by that mammal. In Canada, this is the lower Pacific mainland, west of the Cascades.

An error exists in Rothschild's illustration of the male clasper (1905, pl. VII, fig. 14). This shows process P short and slender, whereas it should be broad, and almost as long as the moveable process F (see fig. 229). A camera lucida sketch, sent to Dr. Jordan, has been compared with the type of *nepos*, and is in agreement with it. The moveable process usually has four spiniforms, but varies from three to five.

New Canadian Records:

B.C.: Alta Lake, 2.IX.42, ex *Tamiasciurus douglassi mollipilosus*, 2♂, 3♀ (I.McT.C.); 6.IX.44, ex *Mustela erminea fallenda*, 1♂, 2♀ (I.McT.C.)
Chapmans, 20.VI.39, ex *Tamiasciurus d. mollipilosus*, 1♂, 8♀ (L.C.C.)
Cultus Lake, various dates, ex *Tamiasciurus d. mollipilosus*, 5♀; 22.XI.40, ex "weasel", 2♂, 1♀ (D.L.); 9.XI.40, ex *Mustela vison energumenos*, 1♂, 1♀ (D.L.)
Gambier Island, 3.VII.39, ex *Tamiasciurus d. mollipilosus*, 2♂, 5♀ (G.P.H.); 21.II.43, ex *T. d. mollipilosus*, 6♂, 14♀ (I.McT.C.)
Harrison Bay, 14.X.42, ex *Spilogale gracilis olympica*, 8♂, 3♀ (G.P.H.)
Howe Sound, VIII.35, ex *Glaucomys s. oregonensis*, 1♀
North Vancouver, 30.V.41, ex *Tamiasciurus d. mollipilosus*, 1♂, 3♀ (J.D.G.)
Vancouver, 24.III.43, ex *Mustela erminea fallenda*, 2♀ (H.D.F.)

Specimens examined: 24♂, 48♀.

ORCHOPEAS SEXDENTATUS AGILIS (Rothschild)

(Plate XXIX, figs. 226, 231, 232; Map 31)

Ceratophyllus agilis Rothschild 1905, Nov. Zool. 12:167-168; pl. VII, figs. 16-18. Both sexes from Banff, Alta. and Carpenter's Mountain, Cariboo District, B.C., ex *Neotoma cinerea*. Also from Banff ex *Ochotona princeps*, Red Deer Alta., ex "*Sciurus richardsonii*" (*Tamiasciurus hudsonicus preblei*); "Canadian National Park" (Banff) ex "*Putorius longicaudatus*" (*Mustela frenata* ssp.) and Penticton, B. C., also ex "*P. longicaudatus*".

Ceratophyllus sexdentatus agilis Rothschild. Jordan 1929, Nov. Zool. 35:30. Designation of Banff, Alta., as type locality and *Neotoma cinerea* as type host.

Ochopeas sexdentatus agilis (Rothschild). Wagner 1936, Can. Ent. 68(9):199. Recorded from Vavenby, Rutland, "Haneville" (Hanceville), Nicola, Salmon Arm, etc., ex *Neotoma cinerea occidentalis*. Also mentions single specimens from *Ochotona princeps* and "*Mustela suturata*" (*M. frenata nevadensis*).

Orchopeas sexdentatus is a true parasite of the woodrat (*Neotoma* spp.) and appears to occur wherever that mammal is established. It is represented by six recognizable races, of which one, *O. sexdentatus agilis* is common from the Rocky Mountains westward in Canada.

Dampf mentions (in litt.) that the race *agilis* is so different from other races of *sexdentatus* that he believes that it should be regarded as a full species. We have many records of this common flea.

There is considerable variation in the degree of incision of sternum VII in the females (fig. 232 a-g). Normally there is a long slender lobe and sinus.

New Canadian Records:

B.C.: Alta Lake, 26.VIII.44, ex *Neotoma cinerea occidentalis*, 2♂, 5♀ (I.McT.C.)
Berg Lake, 25.VII.44, ex *Microtus longicaudus mordax*, 1♂ (G.P.H.); 25.VII.44, ex *Clethrionomys g. saturatus*, 1♂ (G.P.H.)
Birken, 31.VII.39, ex *Ochotona princeps ssp.*, 1♂ (L.C.C.)
Black Mountain, 12.X.40, ex *Ochotona p. brunnescens*, 1♀ (I.McT.C.)
Chezakut 1.IX.41, ex *Neotoma c. occidentalis*, 3♀ (J.F.S.)
Copper Creek, 8.V.42, ex *Ochotona p. fenisex*, 2♀ (G.P.H.)
Cultus Lake, 23.I.41, ex "weasel", 1♂ (D.L.)
Dempsey Lake, 12.VIII.34, ex *N. cinerea occidentalis*, 10♂, 3♀
Emperor Falls, 29.VII.41, ex *Ochotona p. princeps*, 2♂, 1♀ (G.P.H.)
Goodfellow Creek, 14.VIII.45, ex *Neotoma cinerea occidentalis*, 20♂, 24♀ (G.C.C.)

Grey Creek, III.40, ex "weasel", 1 ♂, 2 ♀ (G.O.)
Harrison Bay, 14.X.42, ex *Spilogale gracilis olympica*, 1 ♀ (G.P.H.)
Kamloops, 17.X.37, ex *Mustela frenata* ssp., 2 ♀ (G.P.H.)
Kinbasket Lake, 7.VIII.43, ex *Neotoma cinerea* ssp., 8 ♂, 19 ♀ (G.P.H.); 12.VIII.44, ex *Neotoma cinerea* ssp., 2 ♂, 8 ♀ (G.P.H.)
Lac la Hache, 4.VII.42, ex *Neotoma c. occidentalis*, 49 ♂, 86 ♀ (G.C.C.)
Mt. McLenna, 12.VIII.34, ex *Neotoma cinerea* ssp., 1 ♂
Nulki Lake, 14.V.45, ex *Neotoma cinerea* ssp., 3 ♀ (J.A.M.)
Osoyoos, 21.V.41, ex *Sylvilagus n. nuttalli*, 1 ♀ (I.McT.C.)
Paradise Mine, 26.VIII.44, ex *Neotoma c. occidentalis*, 7 ♂, 12 ♀ (G.P.H.)
Puntchesakut, 31.VIII.44, ex *Neotoma cinerea* ssp., 1 ♂, 5 ♀ (J.A.M.)
Radium Hot Springs, 30.VI.43, ex *Neotoma cinerea occidentalis*, 2 ♂, 1 ♀
Rayleigh, various dates, ex *Neotoma c. occidentalis*, 53 ♂, 105 ♀
Redstone, 13.VII.44, ex *Ochotona princeps* ssp., 2 ♂, 4 ♀ (L.J.)
Revelstoke, 25.X.40, ex *Neotoma c. occidentalis*, 2 ♂, 17 ♀
Robbin's Range, 22.IV.40, ex *Ochotona p. brooksi*, 1 ♂ (G.P.H.)
Silver Creek, various dates, ex *N. c. occidentalis*, 75 ♂, 107 ♀ (J.D.G.)
Sullivan River, 13.VII.44, ex *Ochotona p. princeps*, 3 ♂ 1 ♀ (G.P.H.)
Tappen, IV-VIII.38, ex *Ochotona p. brooksi*, 4 ♂, 3 ♀ (G.P.H.)
Tranquille, various dates, ex *Neotoma c. occidentalis*, 22 ♂, 41 ♀.
Trinity Valley, 31.VII.46, ex *Neotoma cinerea occidentalis*, 5 ♂, 5 ♀ (D.K.C.)
Tulameen, 7.V.42, ex *Neotoma c. occidentalis*, 6 ♂, 7 ♀ (G.P.H.)
Vavenby, ex *Neotoma c. occidentalis*, 1 ♂, 1 ♀ (E.H.)

Specimens examined: large series, of both sexes.

ORCHOPEAS HOWARDII (Baker)

(Plate XXIX, figs. 233, 234; Map 30)

Pulex wickhami Baker 1895, Can. Ent. 27:109,111. Female, from Iowa City, Iowa, ex "*Sciuropterus volans*" (*Glaucomys v.*).

Pullex gillettei, Baker 1895, Can. Ent. 27:109,111. Synonym.

Pulex howardii Baker, 1895, Can. Ent. 27:110,112. Synonym.

Pulex howardii Baker. Baker 1899, Ent. News 10:37. Indicates the synonymy and selected *howardii* as the name to stand.

Ceratophyllus wickhami (Baker). Baker 1904, U. S. Nat. Mus. Proc. 27:387,403,448; pl. XXVI, figs. 1-7. States "Later studies have convinced me that the three squirrel fleas which were described by me in the "Preliminary Studies" are one and the same. They were separated on characters, the value of which, at that early stage in the work and without precedent to follow, was impossible to correctly estimate. The above name, having priority over the others, is the one to be used".

Orchopeas wickhami (Baker). Jordan 1933, Nov. Zool. 39:71-72.

Orchopeas howardii (Baker). Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:33. Revive the name *howardii* on the authority of Baker's 1899 paper.

Orchopeas howardii (Baker). Jameson 1943, Journ. Mammal. 24(2):195-196. Recorded from Welland Co., Ont., ex *Tamias striatus lysteri*, *Tamiasciurus hudsonicus loquax*, and *Glaucomys volans*.

Orchopeas wickhami (Baker). Baker 1944, Journ. Expt. Med. 84(1):47. Recorded from Grosse Isle, Que., ex *Tamiasciurus hudsonicus gymnicus*.

Baker's unfortunate treatment of this species has led to disagreement to the present day as to just what it should be called. The name *wickhami* has line priority and Baker himself in 1904 states that this name should be used. However, in 1899 he had expressed the opinion that the name *howardii* should stand. Ewing and Fox revived the name *howardii* on the strength of this. Dr. Karl Jordan, in answer to an inquiry from the writer as to his opinion on this matter stated "The name of the flea to which Baker gave three trivial names (*wickhami, howardii, gillettei*) is *Orchopeas wickhami*. The Code of Rules of Zoological Nomenclature does not expressly give priority to the name first printed on a page, but line priority is implied in the Rules and has generally been applied since the acceptance of priority. Baker had no right in 1899 to give priority to *howardii*. The original descriptions have nomenclatorially equal standing". Nonetheless, Article 28 of the International Rules stipulates that the name selected by the first reviser shall stand.

Orchopeas howardii appears to be a true parasite of the grey squirrel, *Sciurus carolinensis* and is evidently limited distributionally by the occurrence of that mammal, although, upon occasion it is taken on other species of hosts. It is now well known in England and Ireland where grey squirrels have been artificially introduced. While there are no records at hand as yet, it probably also occurs at Vancouver, B.C., and other scattered localities in Canada (southern Manitoba, parts of Quebec, New Brunswick, etc.) where *S. carolinensis* has been introduced.

The shape of the processes of the claspers of the male is very characteristic, process P being pointed apically, and F as broad as it is long (fig. 233).

The shape of sternum VII in the female (fig. 234) appears to be very constant, there being a small but distinct sinus, situated low down.

New Canadian records:

Ont.: Chatham, 9.X.44, ex *Sciurus carolinensis leucotis*, 5♂, 17♀ (A.A.W.)
London, 10.VII.30, ex *Sciurus c. leucotis*, 7♀ (E.D.)
Louisville, 14.IV.44, ex *Sciurus c. leucotis*, 1♀ (A.A.W.)
Pottageville, 12.VII.32, ex *Sciurus c. leucotis*, 2♂, 8♀ (C.H.D.C.)
Rondeau, 21.X.43, ex *Glaucomys v. volans*, 2♀ (A.A.W.)
St. Thomas, 22.VIII.19, ex "black squirrel" (*Sciurus c. leucotis*) 1♀ (C.E.J.)
Toronto, 29.IX.36, ex *Sciurus c. leucotis*, 6♀ (E.B.)

Specimens examined: 10♂, 45♀.

TARSOPSYLLA Wagner

Genotype: *Ctenonotus octodecimdentatus* Kolenati 1863 (palaearctic)
Ctenonotus Kolenati 1863, Horae Soc. Ent. Ross. 2:34.
Tarsopsylla Wagner 1927, Konowia 6:108,110 (=*Ctenonotus*, preoccupied).
Tarsopsylla Wagner. Jordan 1933, Nov. Zool. 39:72.
Tarsopsylla Wagner. Ewing and Fox 1943, U.S.D.A.Misc. Pub. 500:31-32.

Eye well developed. No clypeal tubercle. But one lateral seta on fore femur. Segment I of hind tarsus longer than segments II, III and IV together. 1st pair of plantar bristles on all tarsi V shifted ventrally. There are dorsal apical spinelets on the anterior abdominal terga in both sexes (stated to be absent by Ewing and Fox 1943:32).

Males with three antepygidial setae, the upper one minute. Apodeme of tergum IX as long as the manubrium. Inner dorsal area of tergum VIII with spiculose area. Moveable process of clasper long with a number of well developed marginal setae. Sternum VIII with a long apical seta and a membranous appendage.

Females with three or four antepygidial setae. Head of spermatheca barrel-shaped.

A holarctic genus. Three species are known, two in eastern Europe and northern Asia, and one in western North America. Tree squirrels of various genera appear to be the true hosts.

TARSOPSYLLA COLORADENSIS (Baker)

(Plate XXX, figs. 235, 236, 237, 238, 239; Map 19)

Pulex coloradensis Baker 1895, Can. Ent. 27:110,112. A single male from Georgetown, Colorado, ex "Fremont's chickaree" (*Tamiasciurus fremonti* ssp.).

Ceratophyllus coloradensis (Baker). Baker 1904, U. S. Nat. Mus. Proc. 27:388,417,441; pl. 25, figs. 6-9.

Tarsopsylla coloradensis (Baker). Jordan 1933, Nov. Zool. 39:72.

Tarsopsylla coloradensis (Baker). Spencer 1936, Ent. Soc. B. C. Proc. 32:13. Recorded from B.C., but without collection data, on information received from the British Museum, Tring.

Tarsopsylla coloradensis (Baker). Wagner 1936, Can. Ent. 68(9):199. Suggests that it might occur in B. C.

Tarsopsylla coloradensis (Baker). Holland 1941, Ent. Soc. B. C. Proc. 37:11. Recorded from Tetana Lake, B.C., ex *Glaucomys sabrinus alpinus*.

Opisodasys jellisoni Fox 1941, Ent. News 52(2):45-47; figs. 1-3. Described from Boise, Idaho, ex *Glaucomys sabrinus bangsii*. Note: the author examined the types of this species in the U. S. N. M. at Washington, D.C. The male is undoubtedly *Tarsopsylla coloradensis*. The female appears to be identical with *Opisodasys vesperalis* (Jordan) New synonymy.

Tarsopsylla coloradensis (Baker). Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:32; fig. 6, B.

The species is extremely rare in collections, and for many years the type male was the only specimen available for study in North America. Recently, further specimens, of both sexes, have been collected in British Columbia, Alberta and the Northwest Territories. The details of the male genitalia do not agree with Baker's illustration (1904, pl. 25, fig. 9), which shows a number of long setae on F which appear to belong to the overlying tergum VIII. Dr. E. A. Chapin and Major Robert Traub checked the type and compared it with a drawing of a British Columbia specimen prepared by the author. Since then

I have personally examined the type and checked it with Canadian material (and with the male of "*Opisodasys jellisoni*"). They agreed. Accordingly, I am now able to present a corrected illustration of the genitalia of the male (Pl. XXX, fig. 236).

A redescription of the species, giving details of both sexes, is appropriate at this time.

Male. Ocular row of three long setae. Frontal row of about two setae. About three medium setae situated near anterior margin of antennal fossa. Postantennal region with three setae in addition to the marginal row. There are a number of small hairs bordering the anterior and posterior margins of the antennal fossa. Setae of pedicel of antenna about half the length of clava.

Pronotum with a ctenidium of about twenty-two spines. Metanotum with a small apical spinelet.

Abdominal terga I-VII each with two rows of setae. In addition, terga I-IV bear apical spinelets normally as follows: I, 1:1; II, 2:2; III, 1:1; IV, 1:1. Antepygidial setae three, of which the dorsal one is minute and the other two well developed. Tergum VIII bears dorsally about nine medium to long marginal and submarginal setae, as well as about eleven others, disposed laterally and postero-ventrally. Apodeme of tergum IX extending anteriorly slightly beyond apex of the manubrium. Immoveable process of claspers about twice as long as average breadth, and obliquely rounded apically. Moveable process about three times as long as broad, and extending well above P. In addition to some fine hairs and setae, it has on the posterior margin, four heavy setae of which the uppermost is very slightly curved, and equal to the width of F in length. The next two are about twice this length. The fourth seta, at the lower angle is short and hooklike. There are normally two long acetabular setae, but sometimes three, or two on one side and three on the other. Sternum VIII is broad with subparallel margins, and somewhat dilated distally. There is one long apical seta per side and a hirsute apical flap. Ventral arm of sternum IX with deep proximo-ventral lobe. Penis rods short and not completing a convolution.

Female. Chaetotaxy of head essentially as in the male. Setae of pedicel longer than the clava.

Pronotal ctenidium of twenty-one to twenty-four spines.

Abdominal terga I-IV with apical spinelets as in the male. Normally with three well developed antepygidial setae, of which the first is the shortest and the second, the longest. Two specimens in the present series bear three setae on one side and four on the other. Sternum VII divided by a broad sinus into two lobes, of which the upper is more or less sharply acute, and the lower, truncate. There is a certain degree of individual variation (fig. 239 a-e). The head of the spermatheca is barrel shaped, and approximately the length of, or sometimes a trifle longer than, the tail portion. Stylet about three or four times as long as broad, and with two apical setae of which one is longer than the other.

Length, ♂ average 3.1 mm. (2.7 – 3.5 mm.)
♀ average 3.3. mm. (2.8 – 4.1 mm.)

There is evidence that *Tarsopsylla* is a nest flea, which may account for its excessive rarity in collections. We have collected a number of specimens from nests of *Tamiasciurus hudsonicus* ssp. In spite of its long legs, *Tarsopsylla* appears to be a rather sluggish flea, and no specimens were noted to jump vigorously. It is essentially a flea of the mountains and the northlands, like many another in our fauna having close Asiatic relatives.

New Canadian records:

B.C.: Bear Lake, 1.II.38, ex *Glaucomys s. alpinus*, 1♂, 1♀ (J.F.S.F.)
Chilcotin, III.41, ex *Tamiasciurus h. hudsonicus*, 1♀ (G.P.H.)
Hanceville, 27.III.41, ex next of *Tamiasciurus h. hudsonicus*, 3♀ (G.P.H.)
Lac la Hache, 12.X.46, ex next of *T. hudsonicus columbiensis*, 4♂, 1♀ (G.P.H.)
Paradise Mine, 27.VIII.44, ex *T. hudsonicus streatori*, 2♀ (G.P.H.); 31.VIII.44, ex *Glaucomys sabrinus fulginosus*, 3♂, 2♀ (G.C.C.)
Puntchesakut, 9.V.44, ex next of *T. hudsonicus* ssp., 2♀ (J.A.M.)
Redstone, 28.III.41, ex nest of *T. h. hudsonicus*, 5♀ (G.P.H.)
Springhouse, 11.X.46, ex nest of *T. hudsonicus* ssp., 2♂, 5♀ (G.P.H.)
Tatla Lake, 28.III.41, ex *T. h. hudsonicus*, 3♀ (G.P.H.)

Alta.: Jasper, ex *Martes americana* ssp., 1♀ (I.McT.C.)

N.W.T.: Caribou Island, Great Slave Lake, 26.VI.46, ex *T. hudsonicus* ssp., 1♂ (H.T.F.)
Snowdrift, 18.VIII.46, ex nest of *T. hudsonicus* ssp., 1♀ (W.F.)

Specimens examined: 13♂, 27♀, including the type ♂ and the holotype of "*Opisodasys jellisoni* (U.S.N.M.)

CERATOPHYLLUS Curtis

Genotype: *Ceratophyllus hirundinis* Curtis 1832 (palaearctic)
Ceratophyllus Curtis 1832, British Entom. 9:417.
Ceratophyllus Curtis. Jordan 1933, Nov. Zool. 39:75.

In the restricted sense, as now used, the genus includes a large group of species, nearly all of which characteristically infest birds.

Eyes large. Pronotal ctenidium of 24 or more spines. A number of small setae on outer surface of fore femur. No longish thin setae in basal half of mid and hind coxae.

Males with setae of antennal segment II reaching beyond middle of club. One long and two minute antepygidial setae. Tergum VIII with spiculose area on its inner dorsal surface (not greatly developed in some species). Sternum VIII rod-like, with setae and an apical flap. Pigmented setae, but no blunt or heavy spines on moveable process of clasper.

Females with setae of antennal segment II exceeding club. Three antepygidial setae, one long and two shorter. Spermatheca differentiated into head and tail regions, both with conspicuous chitinous thickenings. In most species, the head of this structure is cylindrical throughout its length. In others it may be expanded in the middle.

Holarctic. About fifteen species occur in North America. Ten are known from Canada. They may be separated by the following keys:

Keys to the Canadian species of *Ceratophyllus* s. str.

Males.

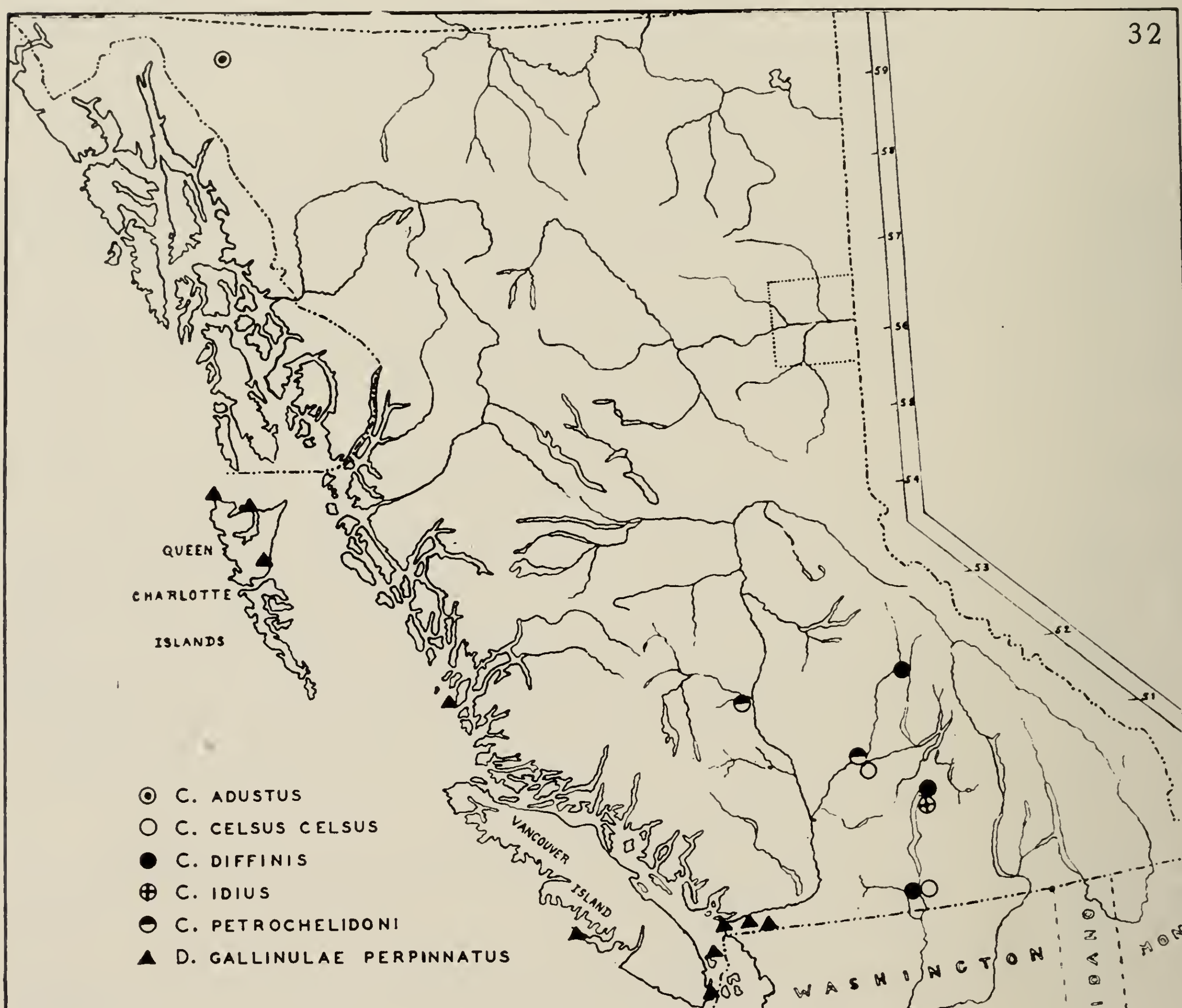
Note: the male of *C. adustus* is not known, but could likely be distinguished by the character of its hind tibia — see key to females — .

1. Apex of F broad 2
   F tapering to a blunt point (fig. 256) . . . . *petrochelidoni*
2. F longer than P 4
   F barely exceeding P 3
3. Inside of dorsal margin of tergum VIII only slightly spiculose (fig. 252) . . . . *idius*
   Tergum VIII with extensive spiculose area (fig. 261) . . . . *tundrensis*
4. Ventral arm of sternum IX with two pronounced and separate ventral lobes, each bearing a heavy patch of setae (fig. 259) . . . . *riparius*
   Ventral arm of sternum IX with anterior lobe pronounced but distal lobe more or less reduced, and appressed to it (example, fig. 246) 5
5. Acetabular setae inserted slightly above articulation of F 6
   Acetabular setae inserted at or slightly below the level of the point of articulation of F . . . 7
6. Length of F more than twice P (fig. 248) . . . . *gallinae*
   F less than twice P (Pl. IV, fig. 6) . . . . *niger*
7. Penis rods and apodemal rod not completing a full convolution 8
   Penis rods and apodemal rod long, and completing a full turn . . . . *celsus celsus*
8. Sternum VIII narrower than F (fig. 246) . . . . *diffinis*
   Sternum VIII broad and tapering apically.
   Widest part almost as wide as F (fig. 250) . . . . *garei*

Females.

1. 3rd and 4th dorsal bristles of hind tibia normal (Plate XXXI, fig. 243) 2
   3rd and 4th dorsal bristles reduced to mere hairs (fig. 241) . . . . *adustus*
2. Head of spermatheca long and cylindrical 4
   Head of spermatheca broader in the middle than at the ends 3
3. Sternum VII entire (fig. 251) . . . . *garei*
   Sternum VII with a broad shallow sinus. Upper lobe somewhat pointed (fig. 247) . . . *diffinis*
4. Sternum VII with sinus 5
   Sternum VII entire 8
5. Upper and lower lobes of sternum VII of approximately equal length 6
   Lower lobe distinctly shorter than upper (fig. 257) . . . . *petrochelidoni*
6. Upper lobe of sternum VII bluntly acute (fig. 253) . . . . *idius*
   Upper lobe more broadly rounded . . . .

7. Sternum VII with about 15 setae per side . . . . dimorphic form of *niger*
Sternum VII with about 30 setae per side (fig. 260) . . . . *riparius*
8. Head of spermatheca nearly twice as broad as tail (fig. 249) . . . . *gallinae*
Head of spermatheca only a little broader than tail 9
9. About 6 strong setae in frontal row . . . . *tundrensis*
About 3 weak setae in frontal row 10
10. 1st and 3rd antepygidial setae very short, less than one quarter the length of the middle one . . . . dimorphic form of *petrochelidoni*
1st and 3rd antepygidial setae more than one quarter the length of middle one 11
11. Dark fleas. About 10 short setae on either side of ventral part of tergum VIII (fig. 254) . . *niger*
Pale fleas. 10-15 short setae and some longer ones on ventral part of tergum VIII (fig. 245) . . . . *celsus celsus*



MAP 32

Ceratophyllidae:Ceratophyllinae. Locality records of the bird-fleas *Ceratophyllus adustus* Jordan, *C. celsus celsus* Jordan, *C. diffinis* Jordan, *C. idius* Jordan and Rothschild, *C. petrochelidoni* Wagner and *Dasypsyllus gallinulae perpinnatus* (Baker).

CERATOPHYLLUS ADUSTUS Jordan

(Plate XXXI, figs. 241, 242; Map 32)

Ceratophyllus adustus Jordan 1932, Nov. Zoo. 38:253-255; text-figs. 10,11. Female from Atlin, B.C., ex "porcupine" (probably *Erethizon dorsatum myops*).

Known only from the type female. The species is unique in the reduction of the bristles of the hind tibia. Dr. Jordan believes that the porcupine may possibly be the true host, although *Ceratophyllus* is regularly a bird-infesting genus. The present writer has collected a number of porcupines and carefully searched them for fleas, but without success.

Specimens examined: None. Figures after Jordan.

CERATOPHYLLUS CELSUS CELSUS Jordan

(Plate XXXI, figs. 244, 245; Map 32)

Ceratophyllus celsus Jordan 1926, Nov. Zool. 33:387-388; text-fig. 4. Males from Okanagan Falls, ex *Riparia riparia.*

Ceratophyllus celsus celsus Jordan. Jordan 1933, Nov. Zool. 39:75.

Ceratophyllus celsus Jordan. I. Fox 1940, Fleas of Eastern U. S. pp. 49-50; pl. XII, figs. 56,57. Redescription, including the female.

Ceratophyllus celsus celsus Jordan. Holland 1941, Ent. Soc. B. C. Proc. 37:12. Recorded from Kamloops, B.C, ex *Riparia riparia.*

This species, like *C. riparius* appears to be a specific parasite of the bank swallow. We have no new records.

Specimens examined: 9♂, 11♀.

CERATOPHYLLUS DIFFINIS Jordan

(Plate XXXI, figs. 246, 247; Map 32)

Ceratophyllus diffinis Jordan 1925, Nov. Zool. 32:111-112, text-fig. 44. Male, from Okanagan Falls, B.C., ex "*Colymbus holboelli*" (*C. grisegena h.*).

Ceratophyllus diffinis Jordan. Jordan 1928, Nov. Zool. 34:182; text-fig. 7. Female described, from Boston, Massachusetts, ex "*Galeoscoptes carolinensis*" (*Dumetella c.*).

Ceratophyllus diffinis Jordan. I. Fox 1940, Fleas of Eastern U.S., pp. 50-51; pl. XII, figs. 58,59.

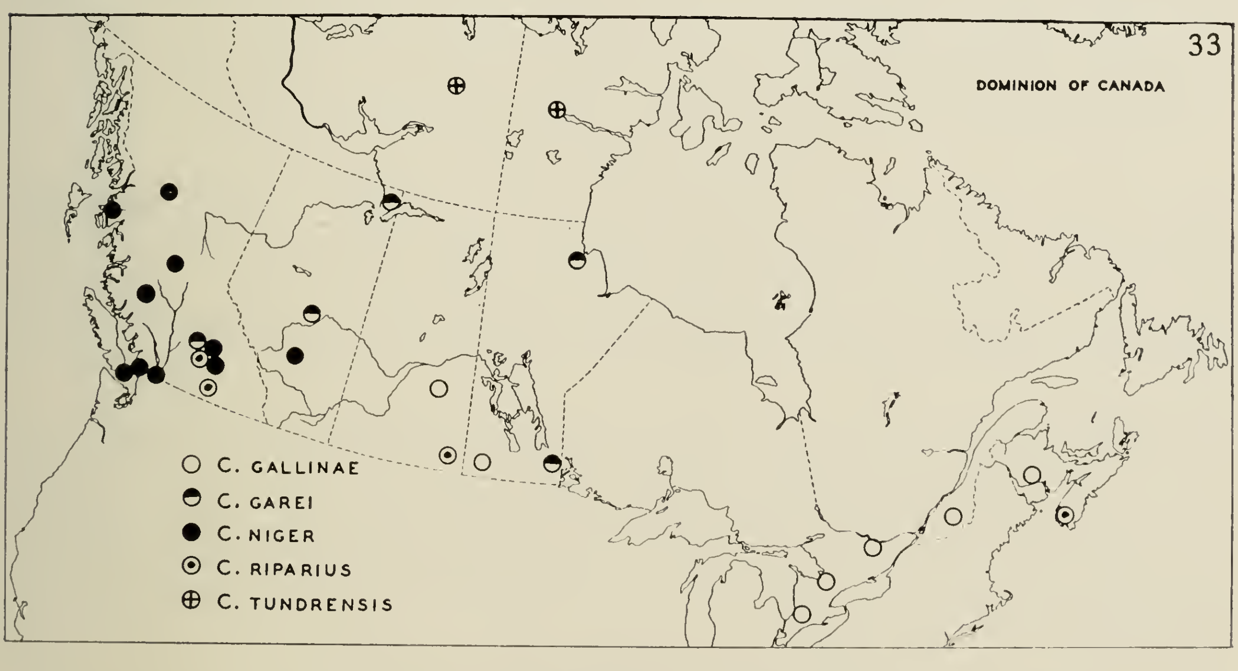
The species occurs on a wide variety of birds across the continent.

New Canadian records:

B.C.: Vavenby, 16.VI.40, ex *Bonassa umbellus*, 1♂ (J.D.G.)
Vernon, 21.VI.41, ex next of *Melospiza melodia morphna*, 15♂, 16♀ (C.D.F.)

Ont.: Brule Lake, Algonquin Park, 6.VII.45, ex *Toxostoma rufum*, 1♀ (C.D.F.); 6.VII.45, ex nest of *Turdus migratorius*, 3♂, 1♀ (C.D.F.)

Specimens examined: 21♂, 20♀.



MAP 33

Ceratophyllidae:Ceratophyllinae. Locality records of the bird-fleas *Ceratophyllus gallinae* (Schrank), *C. garei* Rothschild, *C. niger* C. Fox, *C. riparius* Jordan and Rothschild and *C. tundrensis* Holland.

CERATOPHYLLUS GALLINAE (Schrank)

(Plate XXXII, figs. 248, 249; Map 33)

Pulex gallinae Schrank 1803, Fauna Boica 3:195. From Europe.

Ceratophyllus gallinae (Schrank). Rothschild 1900, Nov. Zool. 7:540-541; pl. IX, figs. 1,2,6,10,13,17,19.

Ceratophyllus gibsoni Fox 1914, Hyg. Lab. Bul. 97:15; pl. V, figs. 4,5. Both sexes from Point Lepreaux, Ottawa, Canada, ex hen house. Synonym, fide Ewing and Fox (1943:69).

Ceratophyllus gallinae (Schrank). Jordan and Rothschild 1920, Ectoparasites 1:70. Recorded from Barker, New York

Ceratophyllus gallinae (Schrank). I. Fox 1940, Fleas of Eastern U. S. pp. 52-54; pl. XIII, figs. 62-63.

C. gallinae, known as the European hen flea, is a species of considerable economic importance, being a well known parasite of poultry in Europe, as well

as eastern North America. Harvey (1907) recorded it from British Columbia, but his specimens were almost undoubtedly *C. niger* (which see). *C. gibsoni* Fox, a synonym of *gallinae*, was described from Ottawa, Ontario. The Canadian Insect Pest Review has at various times reported infestations of this species in localities in Eastern Canada as follows: Forrest, Ont., ex henhouse (1933, 11:35); Henryville, Que. (1934, 12:118); Roanoke, Sask. (1943, 21:232).

New Canadian records:

Sask.: Plunkett, 7.VII.43, ex hen house, 3♂, 5♀ (F.H.C.)

Man.: Aweme, 26.IX.13, ex *Asio wilsonianus*, 5♂, 1♀ (N.C.); 16.X.13, ex *Clethrionomys gapperi*, 2♂ (N.C.); ex poultry, 1♂, 8♀ (N.C.)

Ont.: Kincardine, 19.IV.28, ex man, 2♂
Phelpston, 18.V.39, ex ? 6♀ (C.L.)
Strathroy, 15.VII.36, ex poultry, 3♂, 5♀ (H.F.H.)
Tiverton, 10.V.30, ex man, 1♀

Que.: Victoriaville, 4.VII.41, ex hen house and man, 2♂, 4♀

N.B.: Fredericton, 16.VII.39, ex poultry, 1♂, 1♀ (O.P.)
Gaspereaux, 16.VII.25, ex fowl, 1♂, 1♀

Specimens examined: 36♂, 67♀.

CERATOPHYLLUS GAREI Rothschild

(Plate XXXII, figs. 250, 251; Map 33)

Ceratophyllus garei Rothschild 1902, Ent. Mo. Mag., 2nd series, 13:225; pl. IV, figs. 1-3. Both sexes from Tring England, ex nest of *Gallinula chloropus*.

Ceratophyllus utahensis Chapin 1919. Bul. Ent. Soc. Brookl. 14:60-62. Both sexes from Bear River, Utah, ex *Steganopus tricolor* or *Spatula clypeata*. Synonym, fide Jordan and Rothschild 1920.

Ceratophyllus garei Rothschild. Jordan and Rothschild 1920, Extoparasites 1:69. Recorded from Edmonton, Alta., ex "*Oidemia deglandi*" (*Melanitta d.*).

Ceratophyllus garei Rothschild. Jordan 1929, Nov. Zool. 35:89,92. Recorded from Shoal Lake, Man., ex *Telmatodytes palustris*, and Edmonton, Alta., ex "goose".

Ceratophyllus quebecensis I. Fox 1940, Ent. Soc. Wash. Proc. 42(3):65-66, figs. 3,4. Both sexes from St. Mary's Island, Que., ex "eider down". Synonym (fide Jordan, in a communication to the writer).

This holarctic species is widespread across the northern part of North America, where it occurs on a variety of ground-nesting birds. Wagner described a subspecies *C. garei islandicus*, from Iceland. This would suggest the possibility that the North American form too would be distinct from European *garei*. However, neither Jordan nor Rothschild were able to discern any differences and the status of *C. garei islandicus* is considered dubious.

New Canadian records:

B.C.: Kamloops, 10.VI.45, ex *Erismatura jamaicensis rubida*, 1♀ (G.J.S.); 10.VII.45, ex nest of *E. j. rubida*, 11♂, 28♀ (G.J.S.)

Alta.: Chipewyan, 12.VII.45, ex *Bonassa umbellus* ssp., 1♂, 3♀ (T.M.S.)

Man.: Churchill, 12.VI.30, ex nest of *Zonotrichia querula*, 2♂, 9♀ (H.E.McC.) (P.A.T.)

Specimens examined: 15♂, 42♀, including the types (♂ and ♀) of *C. utahensis* Chapin and *C. quebecensis* Fox (U. S. N. M.)

CERATOPHYLLUS IDIUS Jordan and Rothschild

(Plate XXXII, figs. 252, 253; Map 32)

Ceratophyllus idius Jordan and Rothschild 1920, Ectoparasites 1:73-76; text-figs. 70-72. Both sexes, from Okanagan Landing, British Columbia, ex *Iridoprocne bicolor*.

The species does not appear to be uncommon, although at the present there are no Canadian records available other than the types. Fox (1940:52) gives many records from the Eastern United States. While recorded from a number of species of birds, there is evidence that the tree-swallow is the true host of this flea.

Specimens examined: 4♂, 4♀ (None from Canada. Figures after specimens collected from "nest", Clarksville, Illinois, and from nest of "*Trachycineta bicolor*" (*Iridoprocne b.*), Rock, Massachusetts, received through the courtesy of Dr. Irving Fox, Dr. H. S. Fuller, and Dr. M. A. Stewart).

CERATOPHYLLUS NIGER C. Fox

(Plate IV, figs. 5, 6; plate XXXI, fig. 243; plate XXXII, figs. 254, 255; Map 33)

Ceratophyllus gallinae (Schrank). Harvey 1907, Ent. Soc. B. C. Bul. No. 7, p. 1. Listed under this name from British Columbia. Author's note: Specimens were almost undoubtedly *C. niger*.

Ceratophyllus niger Fox 1908, Ent. News 19:434-435. Described from male, ex man and "*Mus decamanus*" (*Rattus norvegicus*), no locality mentioned.

Ceratophyllus niger Fox. Jordan and Rothschild 1920, Ectoparasites 1:70-71. Recorded from "Essington" (Port Essington), B.C., ex "hen" and Okanagan Landing, B.C., ex "*Planesticus migratorius*" (*Turdus migratorius propinquus*).

Ceratophyllus niger inflexus Jordan 1929, Nov. Zool. 35:37; pl. II, fig. 25. Females, from Custer Co., Colorado. Distinguished from true *niger* by an incised sternum VII. Wagner (1936:200-201) states that a series from a hen house at Abbotsford, B.C., shows both types—i.e. some specimens with sternum VII entire and some with it incised. Believes "*inflexus*" to be but a simple variation.

Ceratophyllus niger niger Fox. Jordan 1929, Nov. Zool. 35:89-92. Recorded from Alberta (undoubtedly from Blackfalds) ex *Meleagris gallopavo*.

Ceratophyllus niger Fox. Wagner 1936, Can. Ent. 68(9):200-201. Recorded from "*Acridotheres cristatellus*" (*Aethiospar c.*), no locality data (actually Vancouver, B.C.).

The species appears to be confined to western North America, although there is one dubious record from New York (Stewart, 1928). It is found on quite a wide variety of indigenous birds, and besides has adapted itself to domestic fowls to such an extent that it is now an economic problem, and has earned for itself the name "Western hen flea". *C. niger*, as its name implies is a very dark species; it is very active, and bites man readily.

New Canadian records:

B.C.: Ballingall Is., 10.V.35, ex nest of *Phalacrocorax* sp., 18♂, 24♀ (T.K.M.)
Galiano Is., 11.IV.35, ex *Phalacrocorax pelagicus resplendens*, 2♂, 5♀
Kamloops, 3.III.40, ex nest of *Turdus* (?) 2♂, 4♀ (G.P.H.); VIII.45, ex nest of *Passer domesticus*, 30♂, 30♀ (P.P.)
Lulu Is., 25.IV.39, ex *Otus asio kennicotti*, 1♀ (K.R.); 7.I.43, ex hen house and household, 1♀.
Tatla Lake, 28.III.41, ex *Tamiasciurus hudsonicus* ssp., 1♂ (G.P.H.)
Nulki Lake, 18.VII.45, ex *Cryptoglaux acadica*, 1♀ (J.A.M.)
Vancouver, 23.II.33, ex *Otus asio kennicotti*, 1♂ (G.J.S.); 11.IV.35, ex *Vermivora c. lutescens*, 1♂ (G.J.S.)
Victoria, ex hens and household (W.D.) (G.C.C.)

Specimens examined: 56♂, 74♀.

CERATOPHYLLUS PETROCHELIDONI Wagner

(Plate XXXII, figs. 256, 257, 258; Map 32)

Ceratophyllus petrochelidoni Wagner 1936, Zeitsch. f. Parasitenk. 8(6):655-656; text-fig. 2. Both sexes from Chilcotin (type locality), British Columbia, ex "*Petrochelidon lunifrons*" (*P. albifrons*). Also a male from Kamloops, B.C., no host data.

The peculiar shape of F in the male (fig. 256) readily distinguishes this species from all others in the genus. *C. petrochelidoni* appears to be rare. The writer has examined many nests of cliff swallows (which are almost undoubtedly the true hosts) for further specimens, but without success. There are no additional Canadian records at this time.

Recently Mr. P. Quentin Tomich of the University of California at Berkeley submitted a series of fleas from Calaveras Dam, Alameda Co., California, ex nest of *Petrochelidon albifrons*. These proved to be *Ceratophyllus petrochelidoni*, and a study of the females showed sternum VII to be dimorphic, being sometimes incised (as in the allotype) and sometimes entire. The extreme shortness of the 1st and 3rd antepygidial setae gives a good recognition character for the females of this species.

Specimens examined: 5♂, 9♀, including the holotype ♂ and allotype ♀.

CERATOPHYLLUS RIPARIUS Jordan and Rothschild

(Plate XXXI, fig.240; plate XXXIII, figs. 259, 260; Map 33)

Ceratophyllus riparius Jordan and Rothschild 1920, Ectoparasites 1:71-73; text-figs. 67-69. Both sexes from Bay View, Milwaukee, Wisconsin, ex nest of *Riparia riparia*.

Ceratophyllus riparius Jordan and Rothschild. Jordan 1929, Nov. Zool. 35:91. Recorded from Okanagan Falls, B.C., ex *Riparia riparia*.

As with *C. celsus celsus* Jordan, the bank swallow, *Riparia*, seems to be the true host of this flea. It is widespread across North America. Fox (1940:55) gives a number of records from the eastern United States.

New Canadian records:

B.C.: Kamloops, VII.39, ex nest of *Riparia riparia*, 12♂, 11♀ (G.P.H.)
Notch Hill, 18.V.45, ex nest of *R. riparia*, 1♂ (G.P.H.)

Sask.: Carlyle Lake, 30.VI.42, ex nest of *Riparia riparia*, 1♀ (G.P.H.)

N.S.: Lower Wedgeport, ex "swallow box", 1♀ (I.J.P.)

Specimens examined: 20♂, 22♀.

CERATOPHYLLUS TUNDRENSIS Holland

(Plate XXXIII, figs. 261, 262; Map 33)

Ceratophyllus tundrensis Holland 1944, Can. Ent. 76(12):242-244; pl. XVII, figs. 1-3. Both sexes from Baker Lake (type locality), Northwest Territories, ex "*Mustela arctica*" (*M. erminea arctica*), and Hanbury Portage, "Clinton, Golden Lake" (Clinton Colden Lake), N.W.T., ex *Martes americana*.

While the type series of this flea was collected from weasel and marten, it seems unlikely that these predators are the true hosts, although *C. lunatus* Jordan and Rothschild 1920, an extremely closely related species from Switzerland, is recorded from *Mustela n. nivalis*. The shape of the clasper (♂) which is narrow and curved in both is very characteristic. The shape and vestiture of F also is similar, but F is much longer in *lunatus*. The apical flap on sternum VIII (♂) of *tundrensis* is much shorter than in *lunatus*. It is possible that *tundrensis* should be considered as a nearctic subspecies of *lunatus*.

The contour of F in the male is not correctly delineated in the original illustration, the very pale anterior margin being misinterpreted. A corrected diagram, made from a paratype is shown on plate XXXIII, fig. 261.

There are no new records at hand of this northern flea.

Specimens examined: 3♂, 3♀ (the type series).

DASYPSYLLUS Baker

Genotype: *Ceratophyllus perpinnatus* Baker 1904
Dasypsyllus Baker 1905, U. S. Nat. Mus. Proc. 29:129,146.
Dasypsyllus Baker. Jordan 1933, Nov. Zool. 39:76.

Pre and postantennal regions each with three rows of setae. Eye large and very dark. Pronotum with a comb of 30 or more spines. A number of small setae on outer surface of fore femur. No longish thin setae in basal half of inner surface of mid and hind coxae. Six pairs of plantar bristles on all tarsi V, of which the 1st, 2nd, 4th and 5th are lateral, the 3rd pair shifted ventrally and its place taken by a pair of thin setae, and the 6th pair (distal) shifted ventrally between the 5th pair (fig. 264).

Moveable process of males with a number of heavy pigmented spine-like setae (fig. 265).

Apical appendage on tail of spermatheca in females.

The genus is widely distributed *. *D. gallinulae* (Dale) is holarctic, being represented in western North America by a subspecies.

DASYPSYLLUS GALLINULAE PERPINNATUS (Baker)

(Plate XXXIII, figs. 263, 264, 265, 266; Map 32)

Ceratophyllus perpinnatus Baker 1904, U. S. Nat. Mus. Proc. 27:386,391-392,445; pl. XIII, figs. 1-6. Male from Queen Charlotte Islands, British Columbia, no host designated.

Ceratophyllus gallinulae Dale. Jordan and Rothschild 1920, Ectoparasites 1:69. (*C. perpinnatus* Baker considered as a synonym). Recorded from "Sumes" (Sumas) B.C., ex *Thryomanes bewicki*.

Ceratophyllus gallinulae perpinnatus Baker. Jordan, 1926, Nov. Zool. 33:386.

* We now have a record of *Dasypsyllus stejnegeri* (Jordan) 1929 from St. Paul Island (Pribilof Group) Alaska, host unknown, but probably some sea bird. This constitutes the first North American record of this little known flea, described from Bering Island and Commander Island, Siberia. Specimen compared with type ♂ (U. S. N. M.).

Ceratophyllus gallinulae perpinnatus Baker. Jordan 1929, Nov. Zool. 35:89-92. Recorded from: Queen Charlotte Islands, ex *Sphyrapicus r. ruber;* Massett, Q. C. I., ex *Cyanocitta stelleri carlottae, Melospiza melodia caurina, Vermivora celata lutescens* and *Hylocichla u. ustulata;* "Sweet Spring Island" (Salt Spring Is.), ex *Lanivireo solitarius cassini.*

Dasypsyllus gallinulae perpinnatus (Baker). Wagner 1936, Can. Ent. 68(9):201. Recorded without details of locality from the following avian hosts in British Columbia; *Cyanocitta stelleri, Hedymeles melanocephalus capitalis, Hylocichla guttata, Junco oreganus scheffeldtii, "Papilio"* (sic!) *maculatus oregonus* (*Pipilo m. o.*), *Penthestes atricapillis occidentalis* and *"Piranega ludoviciana"* (*Piranga l.*). He also recorded it from *"Sciurus douglassi cascadensis"* (*Tamiasciurus d. mollipilosus*).

Dasypsyllus g. perpinnatus is known only along the Pacific coast of North America where it occurs on a wide variety of passerine birds. While many suitable hosts occur east of the coast Mountains, the flea is apparently confined to territory lying to the west, limited possibly by special humidity requirements. (See also discussion on page 30).

New Canadian records:

B.C.: Comox, 21.III.34, ex *Regulus calendula grinnelli,* 1♂ (H.M.L.)
Spider Is., 7.VII.39, ex *Hylocichla guttata,* 1♂ (I.McT.C.)
Huntingdon, 11.IV.41, ex *Zonotrichia coronata,* 1♂ (I.McT.C.)
Langara Is., Q. C. I., 25.V.46, ex *Melospiza melodia* ssp., 1♂, 3♀ (C.J.G.)
Queen Charlotte City, 2.VIII.46, ex *Empidonax d. difficilis,* 2♀ (C.J.G.)
Tofino, 12.VI.26, ex *Cyanocitta s. stelleri,* 1♀ (I.McT.C.)
Vancouver, 1.V.40, ex man, 1♀ (J.D.G.); 20.X.46, ex nest of *Turdus migratorius* ssp., 9♂, 12♀ (G.J.S.)
Victoria, III.46, ex man, 2♂, 1♀ (G.C.C.)

Specimens examined: 16♂, 26♀, including the type ♂ (U.S.N.M.) and 1♂ and 5♀ topotypes.

MALARAEUS Jordan

Genotype: *Ceratophyllus telchinum* Rothschild 1905.
Malaraeus Jordan 1933, Nov. Zool. 39:76.
Trichopsylla Kolenati. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:55-56. (partim)

This genus and the succeeding two (*Megabothris* Jordan and *Monopsyllus* Kolenati) as well as a further genus (*Pleochaetis* Jordan, not found in Canada) have been the subjects of recent controversy. Irving Fox (1940:67) relegated all nearctic *Monopsyllus* to *Megabothris*, reserving the name *Monopsyllus* for palaearctic forms. Ewing and Fox (1943:55-56) went a step further and reduced *Megabothris*, *Malaraeus* and nearctic *Monopsyllus* spp. to synonymy with *Trichopsylla* Kolenati 1863. These three genera are further grouped together as a new subgenus, *Trichopsylla.* (*Pleochaetis* is regarded as another subgenus). Their reason for choosing the name *Trichopsylla* lies in Kolenati's listing of *Pulex penicilliger* Grube here, and Baker's (1904:371) designation of this species as the genotype. (Baker considered *Trichopsylla* a synonym of *Ceratophyllus* Curtis s. lat.). Ewing and Fox state that as *Trichopsylla* Kolenati 1863 antedates *Malaraeus* Jordan 1933 (to which genus Jordan allocates *penicilliger*), the former name should be used.

However, as pointed out by Jordan and Rothschild (1920:63-64) and later again by Jordan (1932:293), Kolenati's generic diagnosis of *Trichopsylla* stipulated the lack of a pronotal ctenidium, and therefore his specimens could not have been *penicilliger* Grube. Jordan and Rothschild believed that Kolenati's material was *Vermipsylla homoeus* Rothschild, a widespread species, and, like Grube's *penicilliger*, also occurring on Mustelidae. On the strength of this, they sank *Chaetopsylla* Kohaut as a synonym of *Trichopsylla*.

Wagner (1933:91-93) on the other hand, believed that Kolenati's error was due to the erroneous surmise that (aside from two dubious *Ctenophthalmus* spp.) only one species of flea, i.e. *penicilliger*, infested *Mustela* (sensu lato) and that as his specimens were taken from that or a closely related genus of mammal, they must, therefore, be *penicilliger*. Kolenati obviously had not consulted the description and diagrams of Grube, which indicate the presence of a pronotal ctenidium. Further, Wagner did not agree with Jordan and Rothschild that Kolenati's "*penicilliger*" was a *Vermipsylla*, but believed that it was more

probably *Pulex irritans* (var. *fulvus* Ioff), a flea common on Mustelids in south Russia. Therefore, in Wagner's opinion, *Chaetopsylla* should be reinstated, and the name *Trichopsylla* be shelved until Kolenati's specimens be found.

In view of the confusion surrounding this name, and Kolenati's obvious error in identifying *penicilliger* (ignoring for the time the possibility of *Malaraeus*, *Megabothris* and *Monopsyllus* being congeneric) the present writer does not feel that the revival of "*Trichopsylla*" helps to clarify this systematic problem.

Opinion No. 65 of the International Rules of Zoological Nomenclature give no general ruling for the case of a genus based upon erroneously determined species.

As regards the stated synonymy, here once more is the matter of the weighing of values, and of individual opinion as to just what constitutes a genus. According to Jordan's interpretation (1933:76-78) the three belong to his "group C", i.e., with a number of lateral setae on femur I and no long thin setae on basal part of inner surface of coxa II and III; all are of the generalized *Ceratophyllus*- type; F in the males of all bears heavy setae which tend to be pigmented and spine-like. But they differ as below:

Malaraeus is separated chiefly on the character of the eye, which is distinctly reduced (Pl. XXXIV, fig. 273) its longest diameter being shorter than the distance from the lower edge of the eye to the angle of the sclerotized portion of the gena[1] lobe.

In the other two (Pl. I, fig. 1; pl. XXXIV, fig. 276), the eye is larger, and its greatest diameter is greater than this distance.

Megabothris is separated from *Monopsyllus* and other genera by the greatly enlarged stigma cavity of tergum VIII (Plate XXXV). Ewing and Fox (1943:56) state that this may be so in the genotype *M. walkeri* (Palaearctic) but that it "is not so enlarged in some of the others and hardly makes a good distinguishing character". In the present writer's experience, there is no particular difficulty in discerning this huge cavity in males or females of the nearctic species usually allocated here (although he has not examined *M. immitis* or *M. ponerus*), but noting that its development does vary somewhat in different species, although in none does it approach the smallness of the stigma cavity in *Malaraeus* (see plate XXXIV) and *Monopsyllus* (Plate XXXVIII). Still, of course, the question of the generic value of such a character remains open to discussion and opinion. Certainly some of the species contained in "*Megabothris*" show striking affinities to certain species in "*Monopsyllus*", especially in the shape of certain parts of the male genitalia, particularly the moveable process (F). Some examples are *Monopsyllus exilis* (Jordan), which resembles *Megabothris acerbus* (Jordan); and *Monopsyllus ciliatus* (Baker), which suggests *Megabothris asio* (Baker). The relationship of the whole group is very complex.

Ewing and Fox regard palaearctic *Monopsyllus* as a valid genus, but believe that the nearctic species that up until now have been relegated to it are not congeneric, and should be included with *Malaraeus* and *Megabothris* in "*Trichopsylla*". They consider true *Monopsyllus* not to occur in North America. On the other hand, Wagner (1936:199) points out the close similarity between the Nearctic *Monopsyllus vison* (Baker) and the Palaearctic *M. sciurorum* (Schrank) (the genotype of *Monopsyllus!*), remarking that the former replaces the latter in the New World, and like it, normally infests squirrels.

Ioff (1936) regards *Megabothris*, *Monopsyllus*, *Ceratophyllus*, *Malaraeus*, *Pleochaetis*, *Nosopsyllus* and the Palaearctic *Citellophilus* and *Callopsylla* all as subgenera under *Ceratophyllus* Curtis. Each subgenus he further divides into "groups". The Nearctic species included in *Monopsyllus* and one Siberian species he designates as Group 3, and suggests the name *Amonopsyllus* for it.

In the present paper, *Malaraeus*, *Megabothris* and *Monopsyllus* are regarded as full genera as defined by Jordan (1933), pending further study of the situation.

Eight nearctic species of *Malaraeus* have been described. Of these, four are recorded from Canada.

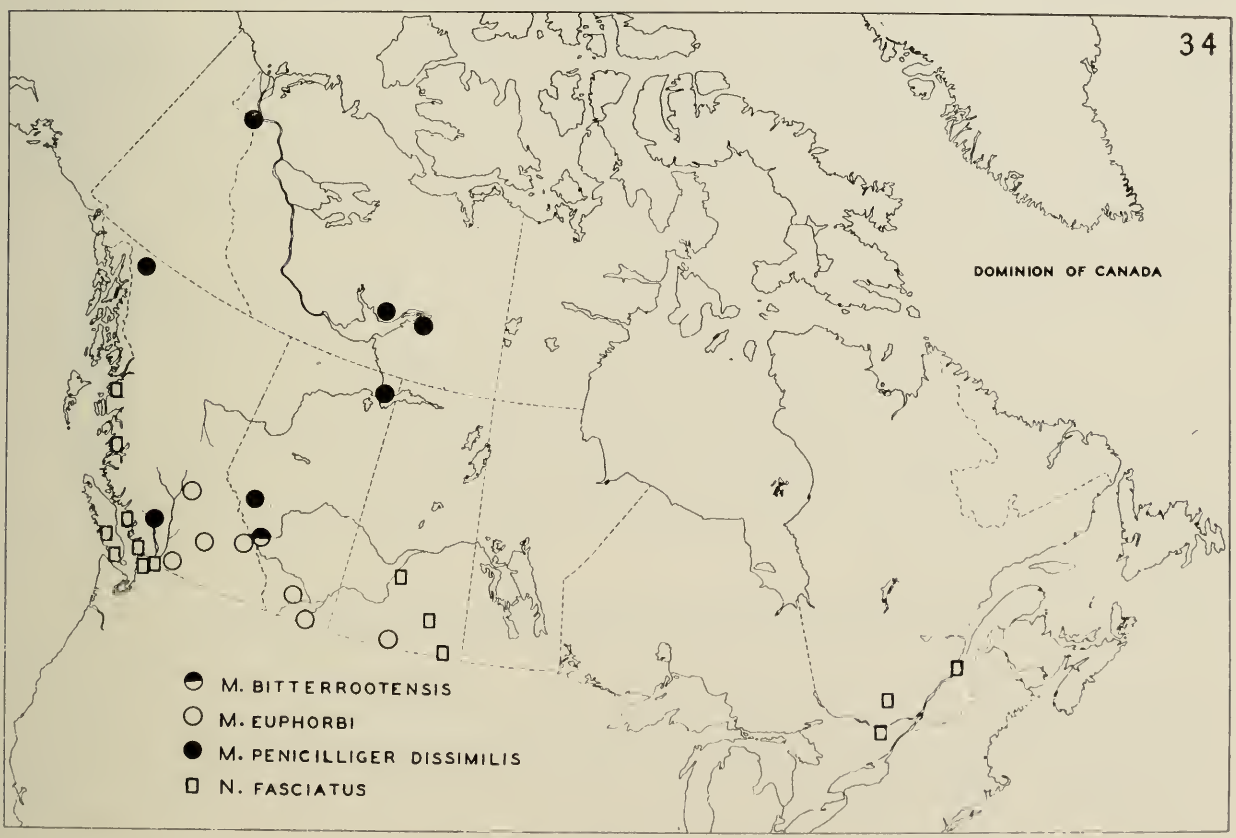
Keys to the Canadian species of *Malaraeus*

Males.

1. Sternum VIII a long slender sclerite, with a few long apical setae and a membranous appendage; F of various forms 2
   Sternum VIII vestigial, and covered by sternum VII.
   F with three subequal spiniforms on the posterior margin, and a long pigmented seta above and below (fig. 271) . . . . *telchinum*
2. F and P of near equal length. Sides of F subparallel with a number of pointed setae, some pigmented. Sternum VIII curving upwards posteriorly 3
   F distinctly longer than P, and sub-triangular in outline, bearing two short blunt spiniforms at the posterior angle and two longer pointed ones spaced between here and the apex. Sternum VIII bent sharply upwards at the midpoint (fig. 274) . . . *penicilliger dissimilis*
3. Basal process of sternum VIII vertical.
   Sternum VIII with two apical setae. Vertical arm of sternum IX without pronounced posterior hump (fig. 269) . . . . *euphorbi*
   Basal process of sternum VIII strongly leaning backwards. Sternum VIII with 4 or 5 apical setae. Vertical arm of sternum IX with pronounced posterior hump (fig. 267) . . . . *bitterrootensis*

Females.

1. Sternum VII normally with well developed lobes and sinus 2
   Sternum VII with slight lobe and shallow sinus (fig. 272) . . . . *telchinum*
2. Upper lobe narrower than sinus 3
   Upper lobe much broader than sinus (variable) (figs. 275, 277 . . . . *penicilliger dissimilis*
3. Head of spermatheca distinctly longer than tail (fig. 270) . . . . *euphorbi*
   Head of spermatheca barely as long, or shorter than tail (fig. 268) . . . . *bitterrootensis*



MAP 34

Ceratophyllidae:Ceratophyllinae. Locality records of *Malaraeus bitterrootensis* (Dunn), *M. euphorbi* (Rothschild) *M. penicilliger dissimilis* Jordan, and *Nosopsyllus fasciatus* (Bosc d'Antic).

MALARAEUS BITTERROOTENSIS (Dunn)
(Plate XXXIII, fig. 267; plate XXXIV, fig. 268; Map. 34)

Ceratophyllus bitterrootensis Dunn 1923, Pub. Hlth. Repts. 38:2771-2772-2775. Male from Spoon Creek, southwest of Darby, Montana, ex *Neotoma cinerea*.

Ceratophyllus isus Jordan 1925, Nov. Zool. 32:110, text-figs. 39,40. Both sexes from Red Deer River, Canadian Rocky Mountains, ex "*Mus*" (*Peromyscus?*). Synonym, fide Jordan (1929:36).

Malaraeus bitterrootensis Dunn and Parker. Jordan 1933, Nov. Zool. 39:76.

Malaraeus bitterrootensis Dunn and Parker. Hubbard 1940, Pac. Univ. Bul. 37(6):2-3; figs.

The species appears to be rare. There are no Canadian records aside from the type series of "*isus*". True hosts are probably woodrats (*Neotoma*). See also next species.

Specimens examined: 3♂, 3♀ (Figures drawn from specimens from Montana, loaned through the kindness of Dr. Wm. L. Jellison.)

MALARAEUS EUPHORBI (Rothschild)
(Plate XXXIV, figs. 269, 270; Map 34)

Ceratophyllus euphorbi Rothschild 1905, Nov. Zool. 12:165-166; pl. VI, fig. 11. Male from Horse Creek, British Columbia, ex "*Peromyscus canadensis*" (*P. maniculatus borealis*).

Malaraeus euphorbi (Rothschild). Jordan 1933, Nov. Zool. 39:76.

M. euphorbi has not been recorded in the literature since the description of the type male in 1905. It is closely related to *bitterrootensis* and the females are sometimes rather hard to separate. In the small series of males before the writer, the aedeagal crochets tend to be variable in outline, sometimes appearing broad and leaf-shaped and in other specimens, narrow and curved. It is possible that this variaton is more apparent than real, and due to position of the organ in the mount, or pressure of the coverslip. A male from Kamloops, B.C., was compared with the type by Dr. Jordan. The female has not previously been described or illustrated.

Female. Ocular row of three setae complete. Frontal row reduced to one or two weak setae. Labial palpus reaching fore trochanter. Pronotal comb of about 20 spines.

Metanotum and abdominal terga I-IV bearing 2-1 apical spinelets a side. Three antepygidial setae of which the middle one is the longest, the upper one about one-third of this length and the lower one about two-thirds. Sternum VII deeply incised, the upper lobe being long and narrow (fig. 270) with subparallel sides. The upper lobe is usually slightly narrower than the sinus (as indicated in the key) but is sometimes somewhat broader. Head of spermatheca well sclerotized, barrel-shaped, and tapering somewhat towards the tail, which is distinctly shorter than the head. Tail of spermatheca usually with slight apical papilla.

The species appears to be rare. Of the few specimens collected, most have been taken in the very early spring. *Peromyscus* is apparently the true host.

New Canadian records:

B.C.: Kamloops, 26.III.44, ex *Peromyscus m. artemisiae*, 1♂ (G.P.H.); 18.I.45, ex *P. m. artemisiae*, 1♀ (G.P.H.); 14.XI.46, ex *P. m. artemisiae*, 1♀ (M.S.); 14.III.41, ex nest of *P. m. artemisiae*, 1♂ (G.P.H.)
Manning Park, VIII.45, ex *Peromyscus m.* ssp., 1♂ (G.C.C.)
Williams Lake, 8.IV.44, ex *Peromyscus m.* ssp., 1♂, 4♀ (G.P.H.)

Alta.: Aden, XI.40, ex *Mustela frenata longicauda*, 1♂, 1♀ (J.G.)
Lethbridge, 11.VI.40, ex *Peromyscus m. osgoodi*, 1♂ (G.P.H.)

Sask.: Rock Glen, 2.IX.40, ex *Peromyscus m. osgoodi*, 1♀ (W.F.)

Specimens examined: 7♂, 9♀.

MALARAEUS PENICILLIGER DISSIMILIS Jordan
(Plate XXXIV, figs. 273, 274, 275; plate XXXV, fig. 277; Map 34)

Ceratophyllus penicilliger (Grube). Jordan 1929, Nov. Zool. 35:36. Recorded from Flat, Alaska, ex *Microtus*.

Ceratophyllus penicilliger (Grube). Jordan 1932, Nov. Zool. 38:253. Recorded from Atlin, B.C., ex *Peromyscus maniculatus borealis*.

Malaraeus penicilliger dissimilis Jordan 1938, Nov. Zool. 41:119-120; text-figs. 65,66. Both sexes from Rapids, Alaska, ex "*Evotomys*" (*Clethrionomys*) and Fairbanks, Alaska, ex *Microtus*. (Refers the 1929 record of "*C. penicilliger*" to this subspecies.

Malaraeus penicilliger dissimilis Jordan. Holland 1944, Can. Ent. 76(12):246; fig. 10. Recorded from Reliance, N.W.T., ex *Vulpes fulva* and Arctic Red River, N.W.T., ex *Vulpes* sp.

It is probable that this New World representative of the Palaearctic *M. penicilliger* is fairly common on microtines across the far north of Canada. The

scanty collections available would indicate that it has a distinct preference for an arctic climate, occurring sometimes in the high mountain regions (sub-alpine forest region) as far south as the 50th parallel of latitude.

As shown in fig. 277 a-m, there is a wide degree of variation in the incision of sternum VII. The more southerly specimens may represent another subspecies, but decision must be withheld until longer series, including males, are available for study.

New Canadian records:

B.C.: Tenquille Lake, 30.VII.45, ex *Clethrionomys gapperi* ssp., 2 ♀ (G.P.H.)

Alta.: Chipewyan, 21.VI.45, ex *Clethrionomys gapperi athabascae*, 1 ♂ (W.F.); 31.VIII.45, ex *C. g. athabascae*, 1 ♀ (W.F.)
Maligne Lake (Jasper), 29.VII.44, ex *Clethrionomys gapperi saturatus*, 1 ♀ (I.McT.C.); 26.VII.44, ex *Phenacomys intermedius*, 1 ♀ (I.McT.C.)

N.W.T.: Gros Cap, Great Slave Lake, 23.VI.46, ex *Clethrionomys g. athabascae*, 1 ♀ (W.F.)
Reliance, 18.V.45, ex "Mice", 2 ♀ (P.L.)

Specimens examined: 2 ♂, 12 ♀, including a male paratype and the female allotype, loaned by Wm. L. Jellison.

MAP 35
Ceratophyllidae:Ceratophyllinae. Locality records of *Malaraeus telchinum* (Rothschild).

MALARAEUS TELCHINUM (Rothschild)

(Plate XXXIV, figs. 271, 272; Map 35)

Ceratophyllus telchinum Rothschild 1905, Nov. Zool. 12:153-155; pl. VIII, fig. 21. Described from males, Kicking Horse Canyon, B.C. (type locality), ex "*Evotomys gapperi*" (*Clethrionomys g. saturatus*) and "*Sorex richardsoni*" (*Sorex* sp.).

Malaraeus telchinum (Rothschild). Jordan 1933, Nov. Zool. 39:76.

Malaraeus telchinum (Rothschild). Hubbard 1940, Pac. Univ. Bul. 37(6):1-2; figs. Redescribed, and both sexes figured.

M. telchinum belongs to that section of the genus (along with *M. sinomus* (Jordan) and *M. eremicus* (Baker) in which the males have sternum VIII reduced to a small vestigial structure.

The species is common in western North America, occurring from British Columbia southwards through the Pacific States to California. It does not appear to occur east of the Rocky Mountains. Preferred hosts are deer mice *(Peromyscus)*.

Recently (Burroughs, 1944), it has been demonstrated to be a potential plague vector, and in this connection may be of considerable significance as it infests the Norway rat *(Rattus norvegicus)* readily, as well as native rodents.

New Canadian records:

B.C.: Allison Pass, ex *Peromyscus m.* ssp., (G.C.C.)
Birken, 29.VII.39, ex "mice", 1♂, 1♀ (L.C.C.)
Boston Bar, 6.VII.35, ex *Peromyscus m.* ssp., 2♂ (T.K.M.)
Cawston, 25.V.45, ex *Peromyscus m.* ssp., 3♂ (G.P.H.)
Copper Ck., ex *Peromyscus m.* ssp. (G.P.H.)
Eagle Pass, 8.V.46, ex *Peromyscus m.* ssp., 1♂, 3♀ (G.P.H.)
Forbidden Plateau, V. I., 24.VIII.43, ex *Peromyscus m. interdictus*, 1♀ (G.C.C.)
Gambier Is., 21.11.43, ex *Peromyscus m. austerus*, 1♀ (I.McT.C.)
Garibaldi Pk., 29VII.39, ex *Peromyscus m.* ssp., 3♀ (G.P.H.)
29.VII.39, ex *Clethrionomys gapperi*, 2♀ (G.P.H.)
Graham Island, Q.C.I., 23.VII.46, ex *Peromyscus*, 2♀ (C.J.G.)
Harrison Bay, 18.IV.41, ex *Peromyscus m. austerus*, 1♀ (J.D.G.)
Kamloops, 14.III.41, ex *Peromyscus m. artemisiae*, 2♂, 12♀ (G.P.H.)
Kaslo, 31.V.40, ex *Citellus columbianus*, 1♂ (S.P.Crew)
Kelowna, 8.IV.40, ex *Peromyscus m. artemisiae*, 1♀ (G.P.H.)
Kinbasket Lake, 4.VIII.43, ex *Peromyscus m.* ssp., 1♀ (G.P.H.); 6.VIII.43, ex *Microtus longicaudus mordax*, 1♂ (G.P.H.); 4.VIII.43, ex *Sorex* spp., 1♀ (G.P.H.)
Manning Park, VIII.45, ex *Peromyscus m.* ssp., 2♂, 3♀ (G.C.C.)
Mariwood Lake, 1.IX.43, ex *Peromyscus m. interdictus*, 1♂, 1♀ (G.C.C.)
Mt. Seymour, 27.VI.44, ex *Peromyscus m. oreas*, 1♂, 1♀ (G.P.H.)
Nicola, 4.V.44, ex *Peromyscus m. artemisiae*, 1♂ (G.P.H.)
Nulki Lake, ex *Peromyscus m.* ssp. (J.A.M.)
Okanagan Landing, 10.VIII.40, ex *Peromyscus m. artemisiae*, 1♂, 1♀ (G.P.H.)
Osoyoos, 13.V.42, ex *Peromyscus m. artemisiae*, 1♀ (G.P.H.)
Pitt Is., ex *Peromyscus* sp. (H.D.F.)
Quesnel, 18.VIII.43, ex *Peromyscus m. borealis*, 4♀ (M.S.)
Rayleigh, 29.III.44, ex *Peromyscus m. artemisiae*, 2♂, 3♀ (G.P.H.)
Silver Creek, 26.I.40, ex *Peromyscus m. oreas*, 2♂, 2♀ (J.D.G.)
Tulameen, 7.V.42, ex *Peromyscus m.* ssp., 1♂, 4♀ (G.P.H.)
Westbank, 19.VIII.44, ex *Peromyscus m. artemisiae*, 1♂, 1♀ (G.P.H.)
Williams Lake, 7.IV.44, ex *Peromyscus m.* ssp., 14♂, 32♀ (G.P.H.)
Yellow Point, V.I., XII.44, ex *Peromyscus m.* ssp., 1♂ (A.C.B.)

Specimens examined: 60♂, 100 plus ♀.

MEGABOTHRIS Jordan

Genotype: *Ceratophyllus walkeri* Rothschild 1902 (Palaearctic)
Megabothris Jordan 1933, Nov. Zool. 39:77.
Trichopsylla Kolenati. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:55-56 (partim).

See diagnosis and discussion of this genus under *Malaraeus*, p. 152.

The genus is holarctic. Eleven species and subspecies of *Megabothris* are known to occur in North America. Of these, nine are recorded from Canada.

Keys to the Canadian species of *Megabothris*

Males.

Note: the male of *M. immitis* is not yet known.

1. Process (P) reaching almost to apex of F 2
P only about half the length of F 3

2. Apex of F produced posteriorly, with two short blunt spiniforms. A long pigmented seta at lower angle .... *asio* ssp. 4
Apex of F only slightly dilated, and with one blunt spiniform and a long seta. A long pigmented seta at lower angle. Above this, a short seta which may be blunt and spiniform, or reduced to a slender hair (fig. 289 a-c) .... *lucifer*

3. F with two short blunt spiniforms at apex 5
F with at most one blunt spiniform at apex 6

4. Apex of F noticeably humped (Pl. XLII, fig. 349). Eastern Canada .... *asio asio*
Apex of F somewhat flatter, and produced posteriorly somewhat more. Western Canada. (Pl. XXXV, fig. 282) .... *asio megacolpus*

5. Long heavily pigmented seta at lower angle of F (fig. 285). Pronotal ctenidium of more than 25 spines .... *atrox*
No such pigmented seta (fig. 280).
Pronotal ctenidium of less than 25 spines .... *acerbus*

6. Some of the setae on F short, blunt and heavily pigmented 7
Seta at lower angle long and heavily pigmented.
Remaining setae slender and light coloured (fig. 291) . . . . *quirini*

7. Two pigmented spiniforms and long pointed seta all evenly spaced on posterior margin of F (fig. 278) . . . . *abantis*
Lower spiniform located just above long pigmented seta at lower angle 8

8. Tergum VII with a close group of apical setae, about seven per side (fig. 287) . . . . *groenlandicu.*
Tergum VII without such group of setae (fig. 293) . . . . *obscurus* n. sps

Females.

Note: females of *M. obscurus* and *M. groenlandicus* not yet known. Latter might possibly be the same as *M. immitis*, also recorded from lemmings.

1. Pronotal ctenidium of less than 25 spines 2
Pronotal ctenidium of more than 25 spines . . . . *atrox*

2. Duct of spermatheca conspicuous, due to sclerotization 3
Duct not conspicuous 5

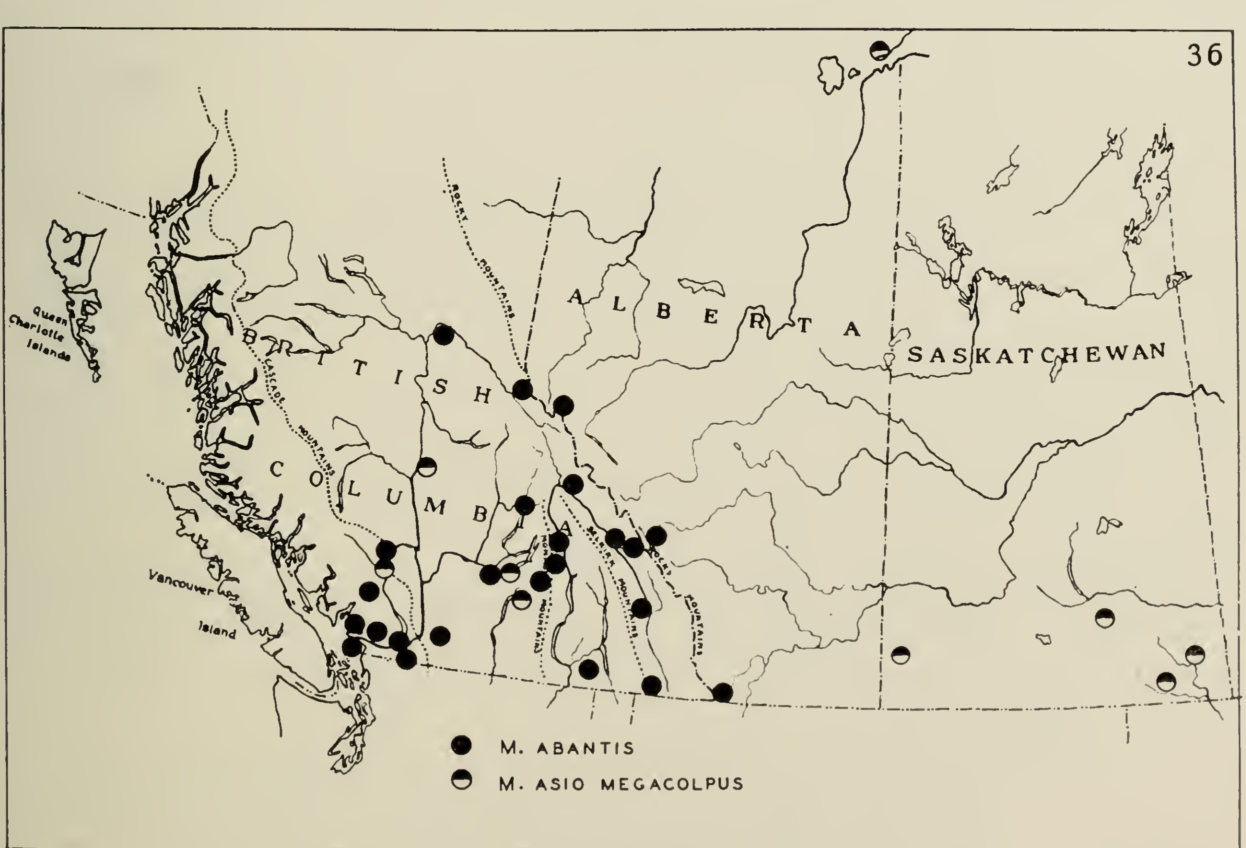
3. Sternum VII with deep sinus (fig. 290) . . . . *lucifer*
Sternum VII without deep sinus 4

4. Sternum VII with pronounced upper lobe (fig. 288) . . . . *immitis*
Upper lobe not as above (fig. 292) . . . . *quirini*

5. Sternum VII with lobe and sinus 6
Sternum VII without pronounced lobe and sinus (fig. 279) . . . . *abantis*

6. Lobe usually pointed, sinus wide and shallow; tail of spermatheca expanded apically (fig. 281) . . . . *acerbus*
Lobe variable; tail of spermatheca not expanded (fig. 283) . . . . *asio* ssp. 7

7. Eastern Canada — limits of range unknown.
Lobe usually rounded, sinus relatively shallow (Pl. XLII, fig. 350) . . . . *asio asio*
Western Canada — limits of range unknown.
Lobe varying, but usually blunt, sometimes squared, and sometimes with dorsal apical hook (Pl. XXXVI, fig. 284 a-k); sinus deep . . . . *asio megacolpus*



MAP 36
Ceratophyllidae:Ceratophyllinae. Locality records of *Megabothris abantis* (Rothschild) and *M. asio megacolpus* (Jordan).

MEGABOTHRIS ABANTIS (Rothschild)
(Plate XXXV, figs. 278, 279; Map 36)

Ceratophyllus abantis Rothschild 1905, Nov. Zool. 12:164-165; pl. VI, fig. 10. Males from "Canadian National Park" (Banff) Alta., ex "*Putorius longicaudatus*" (*Mustela frenata* ssp.) and Horse Creek, B.C., ex "*Microtus drummondi*" (*M. pennsylvanicus d.*).

Megabothris abantis (Rothschild). Jordan 1933, Nov. Zool. 39:77.

Megabothris abantis (Rothschild). Wagner 1936, Can. Ent. 68(9):201. Recorded from British Columbia as follows: Rutland, ex "*Sciurus hudsonicus*" (*Tamiasciurus hudsonicus streatori*); Monte Creek, ex "*Putorius arizonensis*" (*Mustela frenata* ssp.); "Green Lake Mt." (Greenbush Lake, nr. Revelstoke) ex either *Eutamias* or *Ochotona*.

Megabothris adversus Wagner 1936, Zeitsch. f. Parasitenk. 8:654,656-657; text-fig. 4. Female from Vancouver, B.C., ex *Peromyscus maniculatus*. Synonym, fide Holland 1942:158.

Megabothris abantis (Rothschild). Good 1942, Kans. Ent. Soc. Journ. 15(1):7-9; fig. Female described.

Megabothris abantis (Rothschild). Holland 1942, Can. Ent. 74(9):158. Recorded from Waterton Lakes, Alta., ex "*Mustela c. cicognani*" (*M. erminea c.*), and Cultus Lake, B.C., ex "rats" (*Rattus norvegicus?*)

M. abantis (see also discussion, p. 30) is a fairly common parasite of several genera of mice, particularly *Clethrionomys*, *Microtus* and *Phenacomys*, and is most frequently encountered in damp forested areas and at high altitude (subalpine forest, etc.). It appears to be confined to the southern half of British Columbia in Canada, not being known east of the foothills of the Rockies in Alberta.

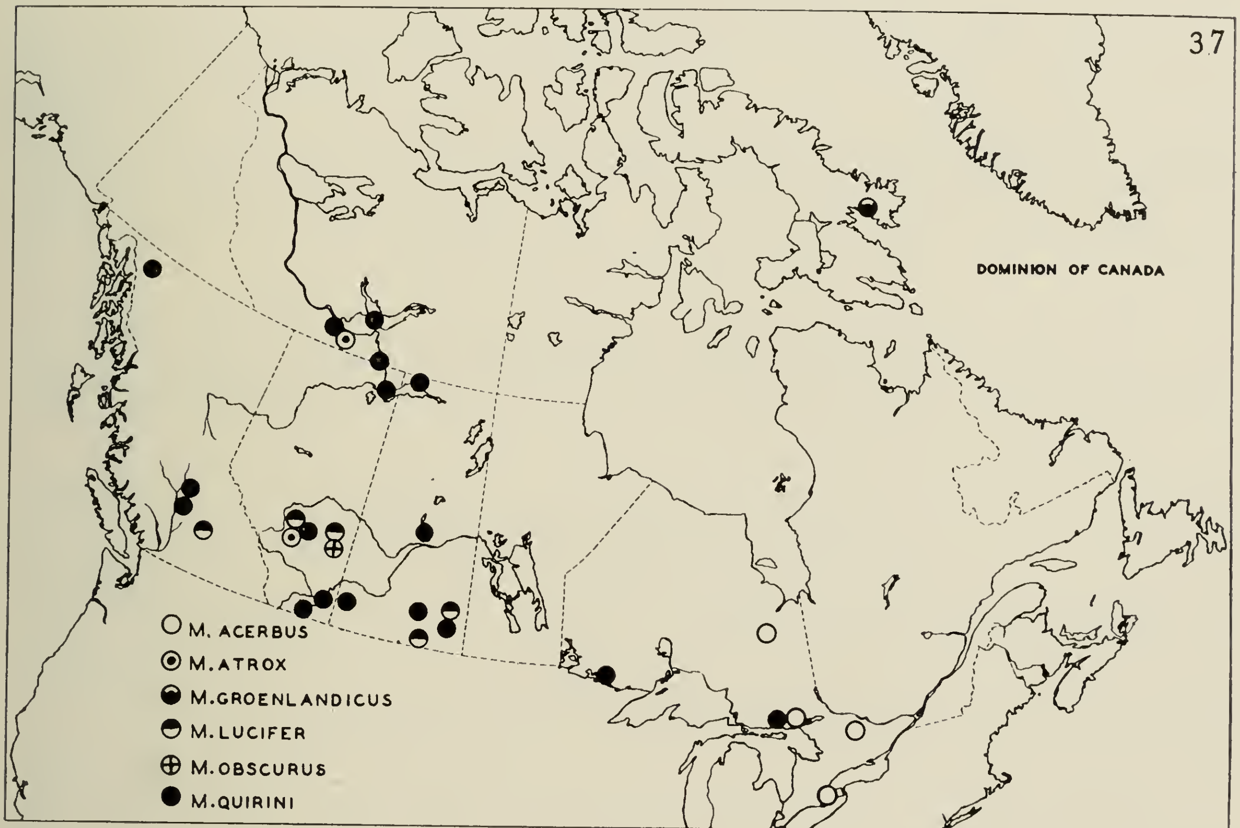
New Canadian records:

B.C.: Aleza Lake, 8.VIII.43, ex *Peromyscus m. borealis*, 2 ♀ (L.C.C.)
Allison Pass, 28.VII.45, ex *Peromyscus m.* ssp., 5 ♀ (G.C.C.); 28.VII.45, ex *Clethrionomys gapperi* ssp., 2 ♀ (G.C.C.)
Alta Lake, 6.IX.44, ex *Mustela erminea fallenda*, 1 ♂, 1 ♀ (I.McT.C.); 1942, ex *Microtus longicaudus macrurus*, 1 ♀ (I.McT.C.); 9.IX.42, ex *Zapus t. trinotatus*, 2 ♂, 1 ♀ (I.McT.C.)
Berg Lake, Mt. Robson, 25.VII.44, ex *Microtus longicaudus mordax*, 1 ♂ (G.P.H.)
Black Mt., ex *Lepus americanus* ssp., 1 ♀ (J.D.G.)
Blanket Mt., 1.VIII.46, ex *Zapus* sp., 2 ♀ (G.P.H.); 1.VIII.46, ex *Clethrionomys g. saturatus*, 1 ♀ (G.P.H.)
Copper Creek, ex *Phenacomys i. intermedius* (G.P.H.)
Cultus Lake, 6.VII.45, ex *Microtus oregoni serpens*, 1 ♂, 1 ♀ (G.P.H.)
Eagle Pass, 8.V.46, ex *Peromyscus m.* ssp., 4 ♀ (G.P.H.)
Field, 11.VIII.44, ex *Clethrionomys gapperi saturatus*, 4 ♀ (J.H.); 2.VIII.44, ex *Phenacomys intermedius*, 1 ♀ (J.H.)
Goodfellow Creek, 15.VIII.45, ex *Microtus* sp., 1 ♀ (G.C.C.); 15.VIII.45, ex *Peromyscus m.* ssp., 1 ♀ (G.C.C.); 14.VIII.45, ex *Neotoma c. occidentalis*, 1 ♀ (G.C.C.)
Harrison Bay, 8.IV.41, ex *Peromyscus m. austerus*, 1 ♀ (G.P.H.)
Kinbasket Lake, 6.VIII.43, ex *Ochotona princeps* ssp., 2 ♂, 1 ♀ (G.P.H.); 12.VIII.44, ex *Neotoma c.* ssp., 1 ♂ (G.P.H.); 6.VIII.43, ex *Zapus princeps idahoensis*, 1 ♂, 1 ♀ (G.P.H.); 9.VIII.44, ex *Zapus p. idahoensis*, 2 ♂, 3 ♀ (G.P.H.); 6.VIII.43, ex *Microtus longicaudus mordax*, 2 ♂, 1 ♀ (G.P.H.); 9.VIII.44, ex *M. l. mordax*, 1 ♂ (G.P.H.); 9.VIII.44, ex *Peromyscus m.* ssp., 1 ♂, 1 ♀ (G.P.H.); 10.VIII.44, ex *Clethrionomys gapperi saturatus*, 3 ♂, 3 ♀ (G.P.H.); 10.VIII.44, ex *Phenacomys intermedius*, 1 ♂, 2 ♀ (A.C.B.); 14.VIII.44, ex *Mustela erminea* ssp., 2 ♂ (A.C.B.)
Manning Park, VIII.45, ex "mouse", 1 ♀ (G.C.C.); 21.VII.45, ex *Eutamias* sp., 1 ♂, 1 ♀ (G.C.C.)
Mons. 26.VIII.32, ex *Microtus richardsonii richardsonii*, 1 ♀ (K.R.)
Mt. Begbie, 8.VIII.41, ex *Clethrionomys gapperi saturatus*, 1 ♀ (G.P.H.)
Mt. Seymour, 27.VI.44, ex *Clethrionomys gapperi* ssp., 3 ♀, (G.P.H.); 27.VI.44, ex *Peromyscus m. oreas*, 2 ♀ (G.P.H.)
Paradise Mine, 26.VIII.44, ex *Phenacomys intermedius*, 2 ♀ (G.P.H.); 27.VII.44, ex *Clethrionomys gapperi saturatus*, 2 ♂ (G.P.H.); 27.VIII.44, ex *Peromyscus m. artemisiae*, 1 ♀ (G.P.H.); 25.VIII.44, ex *Ochotona p. princeps*, 1 ♂ (G.P.H.); 26.VIII.44, ex *Mustela frenata oribasa*, 1 ♀ (G.P.H.)
Peter's Lake, 28.VII.43, ex *Clethrionomys gapperi saturatus*. 2 ♂, 1 ♀ (J.D.G.)
Salmo, 27.V.40, ex *Citellus c. columbianus*, 1 ♀ (S.P.Crew)
Silver Creek, 3.V.41, ex *Peromyscus m. oreas*, 2 ♀ (J.D.G.)
Sugar Lake, 16.V.42, ex *Peromyscus m. artemisiae*, 1 ♀ (G.P.H.)
Tenquille Lake, 30.VII.45, ex *Peromyscus m.* ssp., 1 ♀ (G.P.H.); 30.VII.45, ex *Clethrionomys gapperi* ssp., 1 ♂, 4 ♀ (G.P.H.); VIII.46, ex *C. gapperi* ssp., 2 ♀ (J.R.); 31.VII.45, ex *Synaptomys borealis wrangeli*, 1 ♂ (G.P.H.); 30.VII.45, ex *Zapus* sp., 1 ♀ (G.P.H.)
Timberline Valley, ex *Synaptomys* sp. (G.C.C.); ex *Microtus r. richardsonii* (G.C.C.)
Vancouver, ex *Microtus oregoni serpens* (H.D.F.); 24.IV.41, ex *Rattus norvegicus*, 1 ♀ (F.L.B.)

Vavenby, 5.XI.37, ex *Vulpes fulva*, 1 ♀ (T.K.M.)
Yahk, 24.IV.40, ex *Citellus c. columbianus*, 1 ♂

Alta.: Banff, 14.VII.39, ex *Peromyscus m.* ssp., 1 ♀ (J.D.G.); ex *Phenacomys intermedius* (I.McT.C.)
Maligne Lake, 29.VII.44, ex *Clethrionomys g. saturatus*, 1 ♂ (I.McT.C.); ex *Microtus longicaudus mordax* (I.McT.C.); 24.VII.44, ex *Microtus p. drummondi*, 1 ♀ (I.McT.C.); 26.VII.44, ex *Phenacomys intermedius*, 1 ♀ (I.McT.C.)

Specimens examined: 45 ♂, 90 ♀, including the type of *M. adversus*



MAP 37
Ceratophyllidae:Ceratophyllinae. Locality records of *Megabothris acerbus* (Jordan), *M. atrox* (Jordan), *M. groenlandicus* (Wahlgren), *M. lucifer* (Rothschild), *M. obscurus* n. sp., and *M. quirini* (Rothschild).

MEGABOTHRIS ACERBUS (Jordan)

(Plate XXXV, figs. 280, 281; Map 37)

Ceratophyllus acerbus Jordan 1925, Nov. Zool. 32:111; text-fig. 43. Female from Canada (no exact locality) ex *Tamias striatus*.

Ceratophyllus acerbus Jordan. Jordan 1929, Nov. Zool. 35:170; text-fig. 5. Male described from Adirondacks, New York, ex *Tamias striatus*.

Magabothris acerbus (Jordan). Jordan 1933, Nov. Zool. 39:77.

The species is restricted to eastern North America, where it occurs on the eastern chipmunk, *Tamias striatus* ssp. This mammal appears to be the true host, although all the other fleas of the genus *Megabothris* are more or less restricted to mice.

New Canadian records:

Ont.: Algoma, 24.VIII.35, ex *Tamias striatus griseus*, 1 ♀ (C.H.D.C.)
Brule Lake, 3.VI.34, ex *Tamias striatus griseus*, 1 ♂ (C.H.D.C.); 6.VIII.45, ex *T. s. griseus*, 1 ♀ (C.D.F.)
Buckshot Lake, 21.VII.32, ex "chipmunk", 1 ♂, 1 ♀ (C.H.D.C.)
Simcoe, 22.VIII.34, ex "chipmunk", 1 ♀ (J.A.H.)
Smoky Falls, Kapuscasing, ex "chipmunk", 3 ♀ (R.V.W.)

Specimens examined: 3 ♂, 9 ♀.

MEGABOTHRIS ASIO ASIO (Baker)

(Plate XLII, figs. 349, 350)

Ceratophyllus asio Baker 1904, U. S. Nat. Mus. Proc. 27:388,406-407,440. Described from the female, Wellesley, Massachusetts, ex "*Megascops asio*" (*Otus asio*).

Ceratophyllus asio Baker. Jordan 1929, Nov. Zool. 35:33; pl. 1, figs. 10, 11. Recorded from "field mouse", Ithaca, N.Y., both sexes illustrated.

Megabothris asio (Baker). I. Fox 1939, Ent. Soc. Wash. Proc. 41:47; pl. 6, fig. 3. Description of male.

Trichopsylla (*Trichopsylla*) *asio asio* (Baker). Baker 1946, Journ. Expt. Med. 84(1):47. Recorded from Grosse Isle, Que., ex *Microtus p. pennsylvanicus*.

M. asio asio is confined to eastern North America, where it occurs on, and in the nests of, meadow mice. It is distinguishable from the western subspecies (*M. asio megacolpus*) by the shape of the moveable process of the male claspers. In the eastern race the apical expanded portion of this structure is more strongly rounded dorsally, and not produced posteriorly to the extent that is usual in *a. megacolpus* (cf. figs. 349 and 282). The females are more difficult to distinguish, but in general, sternum VII is not so deeply incised in *a. asio* (cf. figs. 350 and 284).

Aside from two females from Kawene, Ont., VIII.45, ex *Microtus* sp. (A.C.B.) which may be of this subspecies or *megacolpus*, we have no new Canadian records.

Specimens examined: 3♂, 5♀. Figures from specimens received from Robert Traub (Vermont and Delaware). Type ♀ examined (U. S. N. M.)

MEGABOTHRIS ASIO MEGACOLPUS (Jordan)

(Plate XXXV, figs. 282, 283; plate XXXVI, fig. 284; Map 36)

Ceratophyllus megacolpus Jordan 1929, Nov. Zool. 35:33; pl. I, fig. 12. A single female, from Okanagan Landing, ex "*Microtus drummondi*" (*M. pennsylvanicus d.*).

Megabothris megacolpus (Jordan). Jordan 1933, Nov. Zool. 39:77.

Megabothris asio (Baker). Wagner 1936, Can. Ent. 68(9):201-202. Recorded under this name from Salmon Arm, B.C., ex "mouse nest" (Specimen now in University of British Columbia collection.).

Megabothris asio orectus Jordan 1938, Nov. Zool. 41:122; text-figs. 72,73. Both sexes from Ravalli Co., Montana, ex "mouse nest". Possible synonym.

Topotypes from Okanagan Landing, B.C., and a fair series of these fleas from other parts of the province indicate that *megacolpus* is a subspecies of *asio* Baker 1904, and possibly not different from *asio orectus* Jordan 1938. If topotypical material of *orectus* shows no significantly constant differences from *megacolpus* then the former name will have to be suppressed as a synonym.

Specimens from Saskatchewan and Alberta tally well with British Columbia material, and are listed here as *megacolpus*.

The common meadow mouse, *Microtus p. drummondi*, appears to be the true host.

Brown (1944:211) recorded "*Trichopsylla asio asio*" from Hanna, Alberta, ex *Mustela* sp. The writer examined, through Mr. Brown's kindness, the specimen, a female, from which this record was made, and feels that it is referable to *megacolpus*.

New Canadian records:

B.C.: Pemberton Meadows, VIII.45, ex *Microtus* sp., 1♀ (J.R.)
Williams Lake, 7.IV.44, ex nest of *Microtus p. drummondi*, 8♂, 12♀ (G.P.H.); 13.IV.44, ex nest of *M. p. drummondi*, 7♂, 16♀ (G.P.H.)
Alta.: Chipewyan, 30.VIII.45, ex *Microtus* sp., 1♂ (W.F.)
Sask.: Carlyle Lake, 24.VI.42, ex *Microtus p. drummondi*, 2♂, 1♀ (G.P.H.)
Estevan, 28.VII.42, ex *Citellus r. richardsonii*, 1♀ (W.F.)
Maple Creek, 22.V.44, ex *Peromyscus m. osgoodi*, 1♀ (W.F.)
Regina, 16.IX.43, ex *Microtus* sp., 1♀ (W.F.)
N.W.T.: Fort Smith, 31.V.46, ex nest of *Microtus*, 1♂ (W.F.)

Specimens examined: 21♂, 36♀, including the type ♀ (U. S. N. M.), and 1♂ and 1♀ topotype.

MEGABOTHRIS ATROX (Jordan)

(Plate XXXVI, figs. 285, 286; Map 37)

Ceratophyllus atrox Jordan 1925, Nov. Zool. 32:112; text-figs. 45,46. Both sexes from "Blacktalls" (Blackfalds), Alta., ex *Mustela*.

Megabothris atrox (Jordan). Jordan 1933, Nov. Zool. 39:77.

This species is distinguished from all others of the genus by the large number of spines (26-29) in the pronotal ctenidium, this fact suggesting to Jordan that it might be a bird-flea. The male genitalia are very characteristic, the shape of the moveable process (fig. 285) suggesting affinity with *M. asio.* The lobe of sternum VII in the females is very slender and the sinus deep and broad, with a slight angle at about the midpoint of its contour (fig. 286). The species appears to be very rare.

New Canadian record:

N.W.T.: Big Buffalo River, Great Slave Lake, 27.VI.46, ex *Mustela erminea* ssp., 1 ♀ (W.F.)

Specimens examined: 1 ♂, 2 ♀ (1 ♂, 1 ♀ part of the type series, presented by Dr. K. Jordan).

MEGABOTHRIS GROENLANDICUS (Wahlgren)

(Plate XXXVI, fig. 287; Map 37)

Ceratophyllus groenlandicus Wahlgren 1903, Arkiv. för Zool. 1:183; pl. VII, figs. 1,2. A single male, from Kaiser Franz Joseph's Fjord, East Greenland, ex "*Myodes torquatus*" (*Dicrostonyx groenlandicus*).

Megabothris groenlandicus (Wahlgren). Jordan 1933, Nov. Zool. 39: 77.

Megabothris groenlandicus (Wahlgren). Holland 1944, Can. Ent. 76(12):244-245; figs. 6,7. A male recorded from Pangnirtung, Baffin Island, ex *Lemmus trimucronatus*. Redescribed and refigured.

It is quite possible that the specimen described from Baffin Island is racially distinct from true *groenlandicus*, but Wahlgren's illustration of the male genitalia is not sufficiently detailed for certainty in this regard, and his specimen is not available for study. It is quite probable that *groenlandicus* or a subspecies of *groenlandicus* occurs on lemmings (*Lemmus* and *Dicrostonyx*) all across the arctic mainland of Canada, but at present, no collections from these mammals are available.

The female remains unknown, but *Megabothris immitis* (which see) known only from the female, and collected also from a lemming may be closely related if not identical with *groenlandicus.*

There are no new records of *groenlandicus* at hand.

Specimens examined: 1 ♂.

MEGABOTHRIS IMMITIS (Jordan)

(Plate XXXVI, fig. 288)

Ceratophyllus immitis Jordan 1929, Nov. Zool. 35:33-34; pl. I, fig. 13. A single female, from "Lat. 48045, Canada" ex "lemming, probably *Dicrostonyx hudsonius*".

Megabothris immitis (Jordan). Jordan 1933, Nov. Zool. 39:77.

Dr. Jordan states (in litt.) that the collection site as quoted ("Lat 48045") is a typographical error and that the labels reads "Lat. 48° 45N., which would suggest the Adirondacks. However, as there are no true lemmings in these mountains, it may be that the label should have read Long. 48° 45′, which would suggest Greenland. Possibly *immitis* is the female of *groenlandicus.* Subsequent collections from the Canadian northlands may unravel this mystery.

Specimens examined: None, Figure after Jordan.

MEGABOTHRIS LUCIFER (Rothschild)

(Plate XXXVI, figs. 289, 290; Map 37)

Ceratophyllus lucifer Rothschild 1905, Nov. Zool. 12:170-171; pl. VI, fig. 12. Described from two females, from Red Deer, Alta., ex "*Microtus drummondi*" (*M. pennsylvanicus d.*).

Megabothris lucifer (Rothschild). Jordan 1933, Nov. Zool. 39:77.

Megabothris lucifer (Rothschild). Wagner 1936, Zeitsch. f. Parasitenk. 8(6):656; text-fig. 3. Male described, from Kamloops, B.C., ex "*Microtus* sp." (*M. montanus canescens*).

Study of a small series of males of *M. lucifer* in the Kamloops collection has revealed an interesting variation in the development of a certain seta on the moveable process of the claspers.

Wagner's illustration of *M. lucifer* shows the moveable process as long, apically dilated, and with a long apical seta, and immediately below this, a stout, blunt spine. These features are constant in the specimens before the present writer. Posteroventrally the process is expanded, and has a strong, heavily pigmented spine located at the angle. Immediately above this is another seta, which, in our series, shows marked variation. It may be short and pointed as shown by Wagner (as in fig. 289 b); it may be heavier and pyriform like the upper short spiniform (fig. 289 a), or it may be reduced to a tiny hair (fig. 289 c).

Expressing the development of this seta as a, b or c, as shown in the alternatives illustrated, the left and right sides of the ten males of this species available to the writer may be expressed as follows:

Locality	Left	Right
Kamloops B.C.	b−	b−
" "	c+	c
" "	b−	b
" "	b	c
Stanmore, Alta.	c	c
" "	b	b
Estevan, Sask.	a−	a−
" "	a−	b
" "	a	a
" "	c	c

This type of variation is unusual in fleas, although Jordan (1938, Nov. Zool. 41:120) mentions and illustrates a similar case in *Monopsyllus exilis*. It is mentioned here as the point comes up again in the description of a new species, which follows.

M. lucifer appears to be a rather rare species, and while it has been collected from a variety of mammals, the true hosts are probably microtines. In interior British Columbia it shows a special affinity for the grey vole, *Microtus montanus canescens*.

New Canadian records:

B.C.: Kamloops, 20.VII.43, ex *Mustela frenata* ssp., 1♂ (H.D.F.)

Alta.: Stanmore, V.40, ex *Citellus r. richardsonii*, 2♂ (S.P.Crew)

Sask.: Carlyle Lake, 24.VI.42, ex *Microtus p. drummondi*, 1♀ (G.P.H.)
Estevan, 28.VI.42, ex *Peromyscus m. osgoodi*, 1♀ (G.P.H.); 28.VI.42, ex *Microtus pennsylvanicus drummondi*, 1♂, 1♀ (G.P.H.); 23.VII.42, ex *M. p. drummondi*, 2♂ (G.P.H.); 28.VII.42, ex *Citellus r. richardsonii*, 1♀ (G.P.H.); 20.VII.42, ex *Mustela frenata longicauda*, 1♂, 2♀ (G.P.H.)

Specimens examined: 10♂, 9♀.

MEGABOTHRIS OBSCURUS new species

(Plate XXXVII, figs. 293, 294; Map 37)

There are at hand two male fleas which apparently represent an undescribed species. They are from fairly widely separated localities and show certain small differences between each other which are ascribed to individual variation, corresponding closely to the situation just described in *Megabothris lucifer*.

Male. Quite distinct from all other known members of the genus, but showing closest relationship with *M. quirini*.

Ocular row of four long setae. Frontal row of four or five short fine setae. Labial palpus slightly longer than fore coxa.

Pronotal ctenidium with about nine spines per side. These spines are proportionately somewhat shorter than is usual in the genus. Metanotum and abdominal targa I-III with one or two apical spinelets each, per side. One long antepygidial seta on each side, and one or two rudimentary hairs.

Immoveable process of clasper short and somewhat expanded apically, with about three terminal setae. Moveable process large, sub-rectangular. Two strong, pigmented spiniforms at the postero-ventral angle, the upper being short and blunt, and the lower, long and pointed.

At the posterior apical angle a long seta, and below this another seta, which in the holotype is short, pale and pointed (fig. 293) and in the single available paratype, pigmented, stout and blunt (fig. 294). The contour of F in the two specimens varies slightly too, as shown.

The aedeagal crochets are characteristic, having a dorsal indentation, and tapering apically to a point.

Sternum VII bears two or three long curved apical setae and a number of shorter ones along its ventral margin. From near the ventral apical margin of sternum VIII, on each side, arises a membranous appendage which extends dorsally and terminates in a fringe. A more extensively fimbriated portion of the membranous appendage extends posteriorly.

The location of the marginal and lateral setae of tergum VIII (only the alveoli shown) as well as the shape of sternum IX and other details of the genitalia are shown in fig. 293.

Holotype male from Yakima Co., Washington, ex burrow of *Speotyto* sp. (burrowing owl) received through the kindness of Dr. Wm. L. Jellison, and now deposited in the Collection of the Rocky Mountain Laboratory, Hamilton, Montana.

Paratype male collected ten miles north of Stanmore, Alberta by the Sylvatic Plague Survey Crew (under the direction of John H. Brown) of the Department of Public Health of that province, source not recorded (probably either a mouse nest or a burrowing owl burrow) deposited in the Canadian National Collection. This specimen was not used as the holotype due to overclearing in the mounting, which resulted in distortion and the loss of certain setae.

MEGABOTHRIS QUIRINI (Rothschild)

(Plate XXXIV, fig. 276; plate XXXVI, fig. 291; plate XXXVII, fig. 292; Map 37)

Ceratophyllus quirini Rothschild 1905, Nov. Zool. 12:163-164; pl. VI, fig. 1. Males only, from Red Deer, Alta, ex "*Evotomys gapperi*" and "*Evotomys saturatus*" (both probably *Clethrionomys gapperi loringi*).

Ceratophyllus querini (sic!) Rothschild. Jordan 1929, Nov. Zool. 35:171. Mentioned from British Columbia.

Ceratophyllus querini (sic!) Rothschild. Jordan 1932, Nov. Zool. 38:253. Recorded from Atlin, B.C., ex "*Microtus drummondi*" (*M. pennsylvanicus d.*).

Megabothris quirini (Rothschild). Jordan 1933, Nov. Zool. 39:77.

Megabothris quirini (Rothschild). I. Fox 1940, Fleas of Eastern United States, p. 70; pl. XVII, fig. 87; pl. XVIII figs. 90,94. Female described.

This mouse flea is widespread in North America, ranging from the Atlantic States to British Columbia, and northward into the Northwest Territories. Its distribution seems to correspond rather closely to that of *Epitedia wenmanni*, and like that species, it has not been recorded from the Pacific slopes, west of the Cascades.

New Canadian records:

B.C.: Lac la Hache, 7.VII.42, ex *Tamiasciurus hudsonicus columbiensis*, 1 ♀ (G.C.C.); 12.X.46, ex nest of *T. h. columbiensis*, 2 ♂, 2 ♀ (G.P.H.); 12.X.46, ex *Peromyscus m. artemisiae*, 1 ♂ (G.P.H.); 12.X.46, ex *Clethrionomys gapperi saturatus*, 1 ♀ (G.P.H.)
Williams Lake, 7-13.IV.44, ex nests of *Microtus p. drummondi*, 5 ♂, 5 ♀ (G.P.H.)

Alta.: Aden, XI.40, ex *Mustela frenata longicauda*, 1 ♀ (J.G.)
Chipewyan, VI-VIII.45, ex *Clethrionomys gapperi athabascae*, 1 ♂, 9 ♀ (W.F.); VI-VIII.45, ex *Peromyscus m. borealis*, 4 ♀ (W.F.)
Elkwater, 6.VI.40, ex *Sylvilagus nuttalli grangeri*, 1 ♂ (G.P.H.); 7.VI.40, ex *Zapus princeps minor*, 4 ♂, 20 ♀ (G.P.H.); 7.VI.40, ex *Microtus p. insperatus*, 1 ♂, 3 ♀ (G.P.H.); 7.VI.40, ex *Eutamias minimus borealis*, 1 ♂ (G.P.H.)

Sask.: Camsell Portage, 4.VIII.45, ex *Clethrionomys g. athabascae*, 1 ♂, 2 ♀ (W.F.)
Carlyle Lake, 24.VI.42, ex *Clethrionomys g. gapperi*, 2 ♂, 9 ♀ (G.P.H.); 23.VI.44, ex *Microtus p. drummondi*, 1 ♂, 4 ♀ (W.F.); 19.VI.44, ex *Peromyscus m. borealis*, 1 ♀ (W.F.)
Crackingstone Point, 12.VIII.45, ex *Peromyscus m. borealis*, 1 ♀ (W.F.)
Cypress Hills, 12.VII.42, ex *Clethrionomys g. gapperi*, 1 ♀ (G.P.H.)
Emma Lake, 27.V.40, ex "cat", 1 ♂ (L.G.S.); 5.VI.40, ex *Citellus franklinii*, 1 ♂ (L.G.S.)
Goldfields, 12.VIII.45, ex *Microtus* sp., 2 ♀ (W.F.)
Regina, 18.IX.43, ex *Clethrionomys gapperi* ssp., 1 ♀ (W.F.)

Ont.: Algoma, 16.VII.35, ex *Mephitis m. mephitis*, 1 ♀ (C.H.D.C.); 10.VIII.35, ex *Tamiasciurus hudsonicus hudsonicus*, 1 ♂, 1 ♀ (C.H.D.C.); VIII.35, ex *Clethrionomys g. gapperi*, 2 ♂, 3 ♀ (C.H.D.C.); 1.IX.35, ex *Microtus p. pennsylvanicus*, 1 ♂ (C.H.D.C.); 1.IX.35, ex *Napaeozapus i. frutectanus*, 1 ♂, 1 ♀ (C.H.D.C.); 5.IX.35, ex *Zapus* sp., 2 ♀ (C.H.D.C.); 8.VIII.35, ex *Eutamias minimus borealis*, 1 ♀ (C.H.D.C.)
Brule Lake, Algonquin Park, 29.VIII.45, ex *Clethrionomys gapperi* ssp., 1 ♀ (C.D.F.)
Kawene, VII.45, ex "chipmunk", 1 ♀ (A.C.B.)

N.W.T.: Big Buffalo R., 22.VI.46, ex *Mustela erminea* ssp., 1 ♀ (W.F.)
Caribou Is., Great Slave Lake, 26.VI.46, ex *Peromyscus m. borealis*, 1 ♂ (H.T.F.)
Fort Smith, 31.V.46, ex nest of *Microtus*, 1 ♀ (W.F.)
Outpost Is., Great Slave Lake, 3.VII.45, ex *Peromyscus*, 1 ♀ (R.C.M.P.)
Preble Is., Great Slave Lake, 11.VII.46, ex *Clethrionomys g. athabascae*, 1 ♀ (W.F.)

Specimens examined: 35 ♂, 80 ♀.

MONOPSYLLUS Kolenati

Genotype: *Pulex sciurorum* Schrank 1803 (Palaearctic).
Monopsyllus Kolenati 1857, Wien. Entomol. Monatschr. 1:65.
Monopsyllus Kolenati. Jordan 1933, Nov. Zool. 39:78.
Trichopsylla Kolenati. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:55-57 (partim).

See diagnosis and discussion of *Monopsyllus* under *Malaraeus*, page 152.

The genus is holarctic. Eight species, some of which have evolved into a number of recognizable subspecies are recorded for North America. Five species are known to occur in Canada. These, on the basis of the morphology of the spermatheca of the females are divisible into two groups, which also show differences in host preference. Three species (group 1) are common parasites of red squirrels *(Tamiasciurus)* and western chipmunks *(Eutamias)*. The remainder (group 2), two species, one represented by three subspecies, occur on mice, particularly *Peromyscus maniculatus* ssp. in the western provinces and the far north.

Most species of *Monopsyllus* will bite man readily.

Key to the Canadian species and subspecies of *Monopsyllus*

1. Small pale fleas, usually on mice, especially *Peromyscus*
   ♂. F approx. same height as P, triangular, and armed with three black spines, two short ones above and a long one below, all grouped closely together.
   ♀. Spermatheca vermiform, and remarkable in that the tail portion is as wide, or wider than the head 2

   Larger fleas, noticeably dark brown; on *Tamiasciurus* or *Eutamias*.
   ♂. F always much longer than P; variously shaped and armed.
   ♀. Spermatheca proportionately shorter; head and tail well defined, the latter always narrower than the former 5

2. ♂. Penis rods not completing a single turn; spines of F pointed (Pl. I, fig. 1, pl. XXXVIII, fig. 299).
   ♀. Sternum VII with pronounced lobe and sinus (fig. 300 a-h) .... *thambus*

   ♂. Penis rods long and coiled up; spines of F blunt (figs. 303, 305, 307)
   ♀. Sternum VII entire, or with very small sinus (figs. 304, 306, 308) .... *wagneri* ssp. 3

3. Found west of the Cascade Mts. only.
   ♂. F broader than in the two following subspecies, and reaching well beyond P (fig. 305)
   ♀. Constriction near head of spermatheca; tail much dilated (fig. 306) ... *wagneri ophidius*

   Found east of the Cascades only.
   ♂. F and P of approximately equal length
   ♀. No marked constriction at anterior part of head of spermatheca; tail not so dilated. 4

4. Occurring from the Cascades to the Rockies.
   ♂. Genitalia as in fig. 303
   ♀. Sclerotized portion of bursa copulatrix much longer than width of spermatheca (fig. 304) .... *wagneri wagneri*

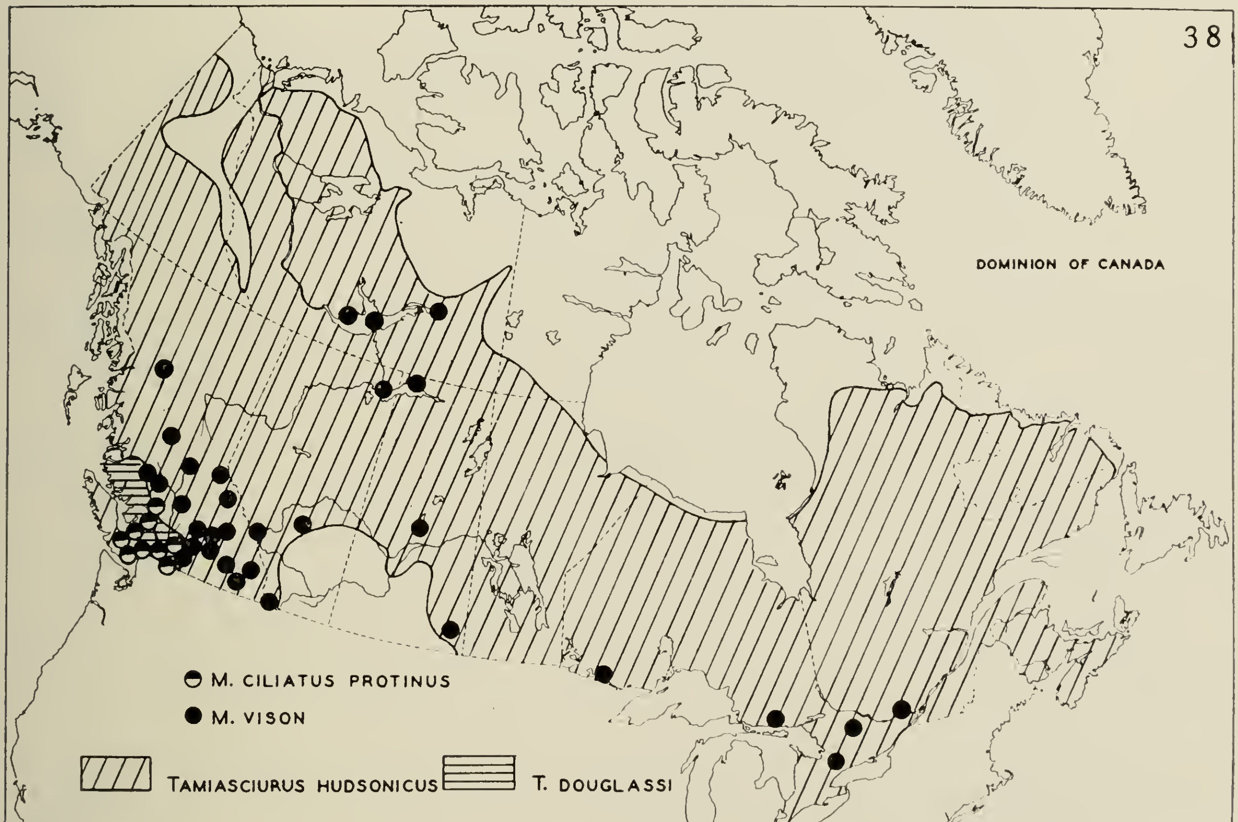
   Found east of the Rocky Mountains only.
   ♂. F somewhat narrower, and the anterior margin more incurved (fig. 307)
   ♀. Sclerotized portion of bursa copulatrix just equalling width of spermatheca (fig. 308) .... *wagneri systaltus*

5. Found west of the Cascades only.
   ♂. F produced backwards at apex, and armed with two short, blunt, stud-like spines (Pl. XXXVII, fig. 295)
   ♀. Head of spermatheca oval, and shorter than tail, Sternum VII with pointed lobe and deep sinus (fig. 296) . . . . *ciliatus protinus*

   Apparently occurring only east of the Cascades.
   ♂. F sub-oblong, and without stud-like spines
   ♀. Head and tail of spermatheca of approximately equal length 6

6. Normally infesting *Eutamias.*
   ♂. F with three evenly spaced blunt spines, two short ones above a long one (fig. 297)
   ♀. Head of spermatheca barrel-shaped. Sternum VII with pronounced blunt lobe (fig. 298) . . . . *eumolpi eumolpi*

   Normally infesting *Tamiasciurus hudsonicus* ssp.
   ♂. F armed with three long, sharp, heavy setae (fig. 301)
   ♀. Head of spermatheca oval. Sternum VII with less lobar development (fig. 302) . . *vison*



MAP 38

Ceratophyllidae:Ceratophyllinae. Locality records of the squirrel-infesting species of *Monopsyllus*, *M. ciliatus protinus* (Jordan) and *M. vison* (Baker), superimposed on ranges of *Tamiasciurus douglassi mollipilosus* and *T. hudsonicus* ssp., as outlined by I. McT. Cowan.

MONOPSYLLUS CILIATUS PROTINUS (Jordan)

(Plate XXXVII, figs. 295, 296; Map 38)

Ceratophyllus ciliatus protinus Jordan 1929, Nov. Zool. 35:34; pl. I, figs. 15,16. Both sexes from Sumas (type locality) B.C., ex *Eutamias townsendii*. Also other localities in B.C.; also from "*Sciurus hudsonicus*" (*Tamiasciurus h.* ssp., prob. *vancouverensis*).

Monopsyllus ciliatus protinus (Jordan). Jordan 1933, Nov. Zool. 39:78.

Monopsyllus ciliatus protinus (Jordan). Wagner 1936, Can. Ent. 68(9):200. Recorded from the following British Columbia localities: Gambier Island, "Joco" (Ioco) and Vancouver, ex *Eutamias townsendii cooperi* and "*Sciurus douglassi cascadensis*" (*Tamiasciurus d. mollipilosus*).

While frequently taken on the various Pacific coast chipmunks, the present writer feels that the tree squirrels *(Tamiasciurus)* are more probably the true hosts of this flea, as it has been collected many times on Vancouver Island, where tree squirrels, but no chipmunks, occur.

The type subspecies of *ciliatus* and another race *(M. c. mononis)* are not known in Canada.

New Canadian records:

B.C.: Allison Pass, 30.VII.45, ex *Tamiasciurus* sp., 2♂, 1♀ (G.C.C.)

Alta Lake, 25.VIII.44, ex *Eutamias amoenus felix*, 2♀ (I.McT.C.); 6.IX.44, ex *Mustela erminea fallenda*, 1♂, 1♀ (I.McT.C.); 2.IX.42, ex *Tamiasciurus douglassi mollipilosus*, 2♂, 3♀ (I.McT.C.)

Birken, 31.VII.39, ex *Eutamias* sp., 2♂ (L.C.C.); 15.IV.40, ex *Tamiasciurus* sp., 1♂, 2♀ (G.P.H.)

Black Mt., 5.VII.36, ex *Lepus americanus* ssp., 1♀ (J.D.G.)

Chapmans, 20.VI.39, ex *Tamiasciurus* sp., 2♂, 6♀ (L.C.C.)

Cowichan Lake, V.I., 16.III.41, ex *T. hudsonicus vancouverensis*, 2♀ (J.H.); 16.III.41 ex *Mustela erminea anguinae*, 1♀ (J.H.); 22.II.41, ex *Martes caurina vancouverensis*, 1♀ (J.H.)

Cultus Lake, 30.V.42, ex *Eutamias townsendii*, 1♂, 5♀ (D.L.); 1.XI.36, ex *Tamiasciurus douglassi mollipilosus*, 3♀ (D.L.)

Harrison Bay, ex *T. douglassi mollipilosus* (J.D.G.); 14.X.42, ex *Spilogale gracilis olympica*, 2♂, 5♀ (G.P.H.); 23.IV.42, ex man, 1♀ (J.D.G.); 14.X.42, ex *Glaucomys sabrinus* ssp., 1♂ (G.P.H.)

Hope, 24.VII.35, ex *T. douglassi mollipilosus*, 1♀ (J.D.G.)

Huntingdon, 1.X.40, ex *T. douglassi mollipilosus*, 1♀ (I.McT.C.)

Kew Beach, 23.VIII.37, ex *T. douglassi mollipilosus*, 2♂, 1♀ (J.D.G.)

Malahat, V. I., 5.VIII.34, ex *T. hudsonicus vancouverensis*, 2♂ (J.D.G.)

Manning Park, 21.VII.45, ex *Tamiasciurus* sp., 1♂ (G.C.C.)

Nanaimo, V. I., 5.VIII.44, ex *Peromyscus* sp., 1♂ (H.D.F.)

New Westminster, III.41, ex *Eutamias townsendii*, 3♂, 3♀ (I.McT.C.)

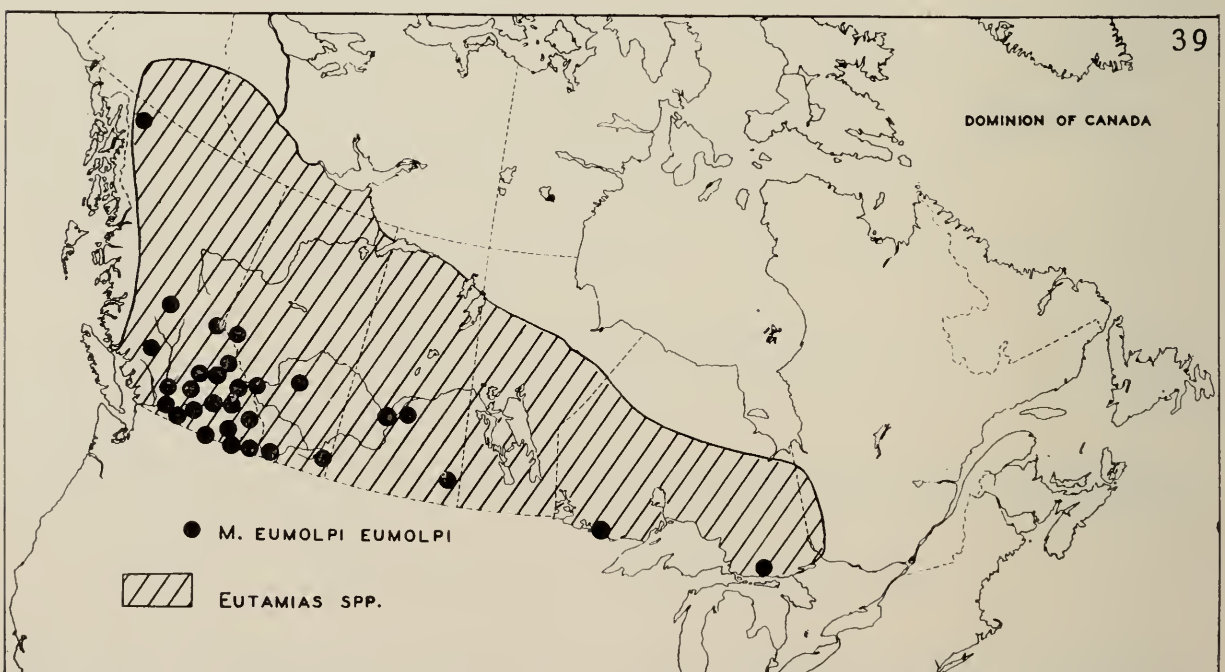
Silver Creek, 3.V.34. ex *Peromyscus m. oreas*, 1♀ (J.D.G.); 4.V.40, ex "girl's ankle", 1♀ (J.D.G.); 19.X.45, ex *Eutamias t. cooperi*, 1♂, 2♀ (J.D.G.)

Steelhead, 6.VI.34, host not recorded, 1♂, 1♀ (K.G.)

Tenquille Lake, 1.VIII.45, ex *Glaucomys sabrinus* ssp., 1♀ (G.P.H.)

Vancouver, 19.II.43, ex *Peromyscus m. austerus*, 1♂ (H.D.F.); 1.XI.40, ex *Spilogale gracilis olympica*, 3♂, 1♀ (I.McT.C.); 3.X.43, ex man, 1♀ (H.D.F.)

Specimens examined: 45♂, 75♀.



MAP 39

Ceratophyllidae:Ceratophyllinae. Locality records of *Monopsyllus eumolpi eumolpi* (Rothschild), superimposed on the range of western chipmunks, *Eutamias* spp., after Howell 1929.

MONOPSYLLUS EUMOLPI EUMOLPI (Rothschild)

(Plate XXXVII, figs. 297, 298; Map 39)

Ceratophyllus eumolpi Rothschild 1905, Nov. Zool. 12:161-162; pl. VI, figs. 2-4. Both sexes from Banff, Red Deer and "Canadian National Park" (Banff), Alta., ex "*Tamias borealis*" (*Eutamias minimus borealis*); from Hospital Creek, Golden, B.C., ex "chipmunk" (*Eutamias*), and Okanagan, ex "*Eutamias quadrivittatus affinis*" (*E. amoenus affinis*).

Ceratophyllus eumolpi eumolpi Rothschild. Jordan 1932, Nov. Zool. 38:253. Recorded from Atlin, B.C., ex "*Microtus drummondi*" (*M. pennsylvanicus d.*).

Monopsyllus eumolpi (Rothschild). Jordan 1933, Nov. Zool. 39:78.

Monopsyllus eumolpi (Rothschild). Wagner 1936, Can. Ent. 68(9):200. Recorded from British Columbia as follows: Stump Lake, Pass Lake, Black Pines, Kamloops, Cold Creek, Nicola, "Green Lake Mt." (Greenbush Lake), all ex *Eutamias amoenus affinis* and Rutland ex squirrel (*Tamiasciurus hudsonicus streatori*).

Monopsyllus eumolpi (Rothschild). Holland 1944, Ent. Soc. B.C. Proc. 41:8. Note on distribution, plague importance, etc.

Two subspecies of *M. eumolpi* are recognized. These, and the closely related *M. fornacis* Jordan and *M. eutamiadis* Augustson appear to be true parasites of western chipmunks *(Eutamias)*. *Monopsyllus e. eumolpi* is probably coincident with the range of *Eutamias* in Canada, with the exception of the lower Pacific coast mainland where, oddly enough, it does not seem to occur.

These fleas are nearly black in colour.

New Canadian records:

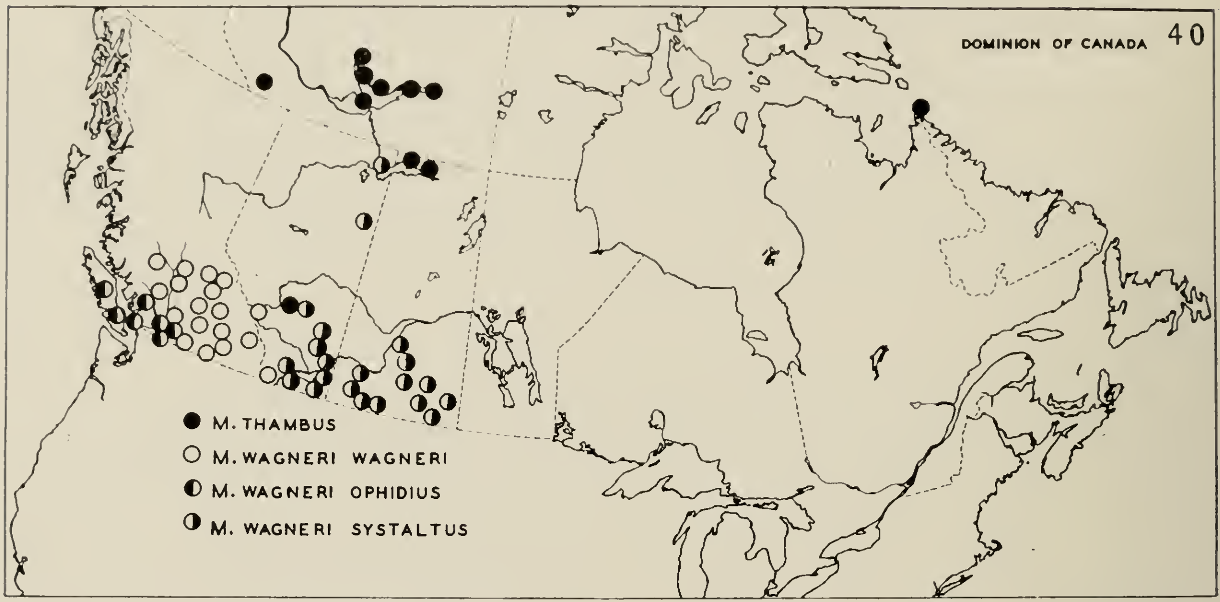
B.C.: Allison Pass, 28.VII.45, ex *Clethrionomys g.* ssp., 1 ♀ (I.McT.C.)
Alta Lake, 11.IX.40, ex *Eutamias amoenus felix*, 1 ♀ (I.McT.C.)
Aspen Grove, 21.VIII.34, ex *Eutamias amoenus affinis*, 1 ♂, 1 ♀ (G.J.S.)
Berg Lake, 26.VII.44, ex *Eutamias amoenus ludibundus*, 1 ♂, 3 ♀ (G.P.H.)
Birken, 30.VII.39, ex *Eutamias* sp., 2 ♀ (L.C.C.)
Boston Bar, 6.VII.35, ex *Eutamias* sp., 1 ♂ (J.D.G.)
Brilliant, 22.VIII.44, ex *Tamiasciurus hudsonicus* ssp., 1 ♀ (G.P.H.)
Canford, 28.III.40, ex *Eutamias amoenus affinis*, 1 ♀ (G.P.H.)
Cascade, 8.VI.40, ex *Citellus c. columbianus*, 1 ♂, 1 ♀ (S.P.Crew)
Chapmans, 24.VI.39, ex *Eutamias*, 1 ♀ (L.C.C.)
Clearwater, 26.VII.32, ex *Eutamias* sp., 2 ♂, 3 ♀ (T.K.M.)
Copper Creek, 8.V.42, ex *Ochotona p. fenisex*, 1 ♀ (G.P.H.); 9.V.42, ex *Eutamias* sp., 5 ♂, 4 ♀ (G.P.H.)
Cranbrook, 9.VI.36, ex *Eutamias* sp., 1 ♂, 1 ♀ (T.K.M.)
Creston, 22.V.40, ex *Citellus c. columbianus*, 1 ♂ (S.P.Crew)
Douglas Lake, 1.VII.43, ex *Eutamias a. affinis*, 1 ♀ (G.P.H.)
Eholt, 15.VI.40, ex *Citellus c. columbianus*, 1 ♂ (S.P.Crew)
Field, 1.VIII.40, ex *C. c. columbianus*, 1 ♀ (S.P.Crew)
Heffley Creek, 8.VII.37, ex nest of *Eutamias a. affinis*, 1 ♂, 3 ♀ (J.D.G.)
Invermere, 11.VII.40, ex *Citellus c. columbianus*, 1 ♂ (S.P.Crew)
Kinbasket Lake, 4.VIII.43, ex *Eutamias* sp., 3 ♂, 4 ♀ (G.P.H.)
Knutsford, 21.VII.40, ex *Eutamias a. affinis*, 1 ♂, 2 ♀ (G.P.H.)
Lower Arrow Lake, 3.VII.34, ex *Eutamias* sp., 2 ♂, 1 ♀ (D.C.)
Manning Park, 21.VI.45, ex *Eutamias* sp., 2 ♂ (G.C.C.)
Mt. Begbie, 7.VIII.41, ex *Eutamias a luteiventris*, (G.P.H.)
Nakusp, IX.44, ex *Eutamias* sp., 1 ♂, 1 ♀ (G.C.C.)
Nulki Lake, ex *Eutamias* sp., 2 ♂, 1 ♀ (J.A.M.)
Osoyoos, 28.VI.40, ex *Citellus c. columbianus*, 1 ♂, 1 ♀ (S.P.Crew)
Paradise Mine, 25.VIII.44, ex *Eutamias minimus selkirki*, 1 ♀ (G.P.H.)
Rayleigh, 16.VII.37, ex *Eutamias a. affinis*, 1 ♀ (G.P.H.); 5.II.41, ex nests of *Tamiasciurus h. streatori*, 1 ♀ (G.P.H.)
Rock Creek, 24.VI.40, ex *Citellus c. columbianus*, 1 ♀ (S.P.Crew)
Roundtop, 13.VII.31, ex *Eutamias* sp., 2 ♀ (T.K.M.)
Sirdar, 23.VIII.44, ex *Eutamias* sp., 3 ♂, 3 ♀ (G.P.H.)
Sugar Lake, ex *Eutamias* sp., (G.P.H.); 16.V.42, ex *Tamiasciurus h. streatori*, 1 ♀ (G.P.H.)
Tenquille Lake, 1.VIII.45, ex *Eutamias* sp., 1 ♂, 1 ♀ (G.P.H.)
Tranquille, 20.VII.34, ex *Mustela frenata* ssp., 1 ♀ (D.C.); VII.33, ex *Eutamias a. affinis*, 2 ♂, 12 ♀ (D.C.)
Trinity Valley, 13.VIII.36, ex man, 1 ♀ (K.G.)
Vavenby, ex *Eutamias* sp., 1 ♂, 1 ♀ (T.K.M.)
Wasa, 4.V.40, ex *Citellus c. columbianus* 1 ♂, 1 ♀ (S.P.Crew)
Wigwam, ex *Eutamias* sp. (G.P.H.); 9.VI.39, ex *Citellus c. columbianus*, 1 ♂ (G.P.H.)
Windermere, 24.VI.40, ex *Citellus c. columbianus*, 1 ♀ (S.P.Crew)
Yahk, 24.IV.40, ex *Citellus c. columbianus*, 2 ♀ (S.P.Crew)

Alta.: Blackfalds, 21.VI.40, ex *Eutamias minimus borealis*, 7 ♂, 12 ♀ (G.P.H.)
Elkwater, 7.VI.40, ex *Zapus princeps minor*, 1 ♂ (G.P.H.); 7.VI.40, ex *Eutamias m. borealis*, 2 ♂, 1 ♀ (G.P.H.)

Sask.: Carlyle Lake, 23.VI.42, ex *Eutamias m. borealis*, 3 ♀ (G.P.H.)
Pike Lake, 20.VII.32, ex *Eutamias* sp., 1 ♀ (L.G.S.)
Saskatoon, 20.IV.45, ex *Eutamias* sp., 6 ♂, 8 ♀ (W.F.)

Ont.: Biggar Lake, 24.VII.35, ex *Eutamias m.* ssp., 1♂, 3♀
Kawene, VIII.45, ex *Eutamias* sp., 7♂, 15♀ (A.C.B.)
Pancake Bay, Algoma, 14.VII.35, ex *Eutamias m. borealis*, 19♂, 24♀ (C.H.D.C.)

Specimens examined: Large series of both sexes.



MAP 40

Ceratophyllidae:Ceratophyllinae. Locality records of the mouse-infesting species of *Monopsyllus*, *M. thambus* (Jordan), *M. wagneri wagneri* (Baker), *M. wagneri ophidius* (Jordan) and *M. wagneri systaltus* (Jordan).

MONOPSYLLUS THAMBUS (Jordan)

(Plate I, fig. 1; plate XXXVIII, figs. 299, 300; Map 40)

Ceratophyllus thambus Jordan 1929, Nov. Zool. 35:36; pl. II, fig. 21. A single male, from Red Deer, Alta., ex *Lynx* sp.

Ceratophyllus bakeri Wagner 1935, Mit. aus den. Zoolog. Mus. in Berlin 18(3):352-353; fig. 13. A single female from Killinek, Labrador, ex "hausmaus" (*Peromyscus?*) *new synonymy.*

Monopsyllus thambus (Jordan). Jordan 1933, Nov. Zool. 39:78.

Monopsyllus thambus (Jordan). Holland 1944, Can. Ent. 76(12):244; figs. 4,5. Recorded from Reliance, Northwest Territories, ex mouse "probably *Mus musculus*" and *Peromyscus m. borealis.* Female described and probable synonymy with *M. bakeri* pointed out.

Further collections of this flea from northern Canada confirm the synonymy with *M. bakeri* in the writer's opinion. Mice, especially *Peromyscus* appear to be the true hosts of this flea, which is closely related to *M. wagneri* of more temperate regions. It is probably one of the commonest mouse-fleas across the Sub-Arctic of Canada.

New Canadian records:

Sask.: Crackingstone Point, 12.VIII.45, ex *Peromyscus m. borealis*, 2♂, 3♀ (W.F.)
Fond du Lac, 16.VII.45, ex *Peromyscus m. borealis*, 2♀ (W.F.)

N.W.T.: Gros Cap, Great Slave Lake, 17.VII.46, ex *Peromyscus m. borealis*, 1♀ (W.F.)
N. shore, Great Slave Lake, 20.VIII.44, ex *Peromyscus* sp., 1♂, 2♀ (P.L.)
McLeod Bay, Great Slave Lake, 17.VIII.44, ex *Peromyscus* sp., 2♀ (P.L.)
Outpost Island, Great Slave Lake, 3.VII.45, ex *Peromyscus* sp., 3♂, 4♀ (R.C.M.P.)
Fort Liard, III.45, ex *Peromyscus* sp., 3♂, 6♀ (R.C.M.P.)
Fort Rae, 27.IV.45, ex *Peromyscus* sp., 1♂, 2♀ (R.C.M.P.)
Pearson Point, 18.VII.46, ex *Peromyscus m. borealis*, 3♂, 4♀ (H.T.F.)
Wildbread Bay, 21.VIII.46, ex *Peromyscus m. borealis*, 4♀ (W.F.)
Yellowknife, 19.VII.44, ex *Peromyscus m. borealis*, 1♀ (P.L.)

Specimens examined: 18♂, 39♀.

MONOPSYLLUS VISON (Baker)

(Plate XXXVIII, figs. 301, 302; Map 38)

Ceratophyllus vison Baker 1904, U. S. Nat. Mus. Proc. 27:388,408-410,448. Both sexes from Peterboro, New York, ex "*Putorius vison*" (*Mustela vison*). Also from Orono, Maine, ex "*Sciurus hudsonicus*" (*Tamiasciurus h.*).

Ceratophyllus lucidus Baker 1904, U. S. Nat. Mus. Proc. 27:388,410-411,444; pl. XX, figs. 5-9. Synonym, fide Jordan (1929:35).

Ceratophyllus vison Baker. Jordan 1929, Nov. Zool. 35:35. Mentioned as occurring in Alberta and British Columbia.

Monopsyllus vison (Baker). Jordan 1933, Nov. Zool. 39:78.

Monopsyllus vison (Baker). Wagner 1936, Can. Ent. 68(9):199-200. Recorded from British Columbia as follows: Nicola Ranges, Riske Creek, Chilcotin, Rutland, "Fish-Lake" (Lac le Jeune), Pass Lake, Black Pines and "Green Lake Mt." (Greenbush Lake), all ex "*Sciurus hudsonicus streatoris*" (*Tamiasciurus h. streatori*) and Monte Creek, ex "*Putorius arizonensis*" (*Mustela frenata* ssp.).

Megabothris vison (Baker). I. Fox 1940, Fleas of Eastern U. S. pp. 72-73; pl. XIX, figs. 95,98,99.

While named after a mink, the true hosts of this common flea are undoubtedly the various races of *Tamiasciurus hudsonicus*. Its distribution appears to be very nearly governed by the occurrence of these squirrels. In Canada, *M. vison* is known from Ontario westward to central British Columbia, where it stops at the Cascade Mountains, like so many other fleas. Northward, it extends well into the Northwest Territories. The Vancouver Island squirrel *(T. hudsonicus vancouverensis)* does not carry this flea, but is infested with *Monopsyllus ciliatus protinus*, like the Pacific coast chickaree, *Tamiasciurus douglassi mollipilosus*.

M. vison shows affinities with the Palaearctic *M. sciurorum*, which also infests tree squirrels.

New Canadian records:

B.C.: Allison Pass, 30.VII.45, ex *Tamiasciurus* sp., 4 ♀ (G.C.C.)
Berg Lake, 25.VII.44, ex *Tamiasciurus hudsonicus* ssp., 1 ♂ (G.P.H.)
Brilliant, 22.VII.44, ex *Tamiasciurus hudsonicus* ssp., 1 ♂, 1 ♀ (G.P.H.)
Chilcotin, III.41, ex *Tamiasciurus hudsonicus* ssp., 2 ♂, 3 ♀ (G.P.H.)
Cranbrook, 23.VIII.44, ex *T. hudsonicus* ssp., 1 ♀ (G.C.C.)
Emperor Falls, Robson, 29.VII.44, ex *Ochotona p. princeps*, 1 ♂ (G.P.H.)
Field, 14.VIII.44, ex *T. hudsonicus* ssp., 1 ♀ (J.H.)
Hanceville, 27.III.41, ex *T. hudsonicus* ssp., 5 ♀ (G.P.H.)
Kamloops, ex *T. hudsonicus streatori* (G.P.H.)
Kinbasket Lake, 4.VIII.42, ex *T. hudsonicus* ssp., 2 ♂, 7 ♀ (G.P.H.)
Kootenay Park, VII.45, ex *Martes americana* ssp., 1 ♂ (J.A.M.)
Kuskonook, 23.VIII.44, ex *T. hudsonicus* ssp., 1 ♂ (G.P.H.)
Lac la Hache, 19.VI.38, ex *T. hudsonicus columbiensis*, 1 ♂ (G.A.M.); 3.VII.42, ex *Glaucomys s. columbiensis*, 2 ♂ (G.C.C.)
Manning Park, 21.VII.45, ex *Tamiasciurus* sp., 2 ♂ (G.C.C.)
Nakusp, IX.44, ex *T. hudsonicus* ssp., 1 ♂, 1 ♀ (G.C.C.)
Nulki Lake, V.45, ex *T. hudsonicus* ssp., 1 ♂, 1 ♀ (J.A.M.)
Paradise Mine, 27.VIII.44, ex *T. hudsonicus* ssp., 1 ♂, 1 ♀ (G.P.H.)
Puntchesakut, 12.V.44, ex *T. hudsonicus* ssp., 1 ♂, 2 ♀ (J.A.M.)
Quesnel, 23.VIII.43, ex *T. hudsonicus* ssp., 2 ♂, 3 ♀ (M.S.)
Quilchena, 10.VII.35, ex *T. hudsonicus streatori*, 1 ♂ (J.D.G.)
Rayleigh, 21.IX.39, ex *T. hudsonicus streatori*, 1 ♂, 5 ♀ (G.P.H.)
Redstone, 28.III.41, ex *T. hudsonicus* ssp.| 1 ♀ (G.P.H.)
Riske Creek, 29.VII.43, ex *T. hudsonicus* ssp., 1 ♂, 3 ♀ (G.P.H.)
Salmon Arm, 7.VIII.39, ex man, 7 ♂, 3 ♀ (E.R.B.)
Springhouse, 11.X.46, ex nest of *T. hudsonicus* ssp., 1 ♂ (G.P.H.)
Sugar Lake, 16.V.42, ex *T. hudsonicus streatori*, 1 ♂ (G.P.H.)
Sullivan River, 13.VIII.44, ex *Ochotona princeps* ssp., 1 ♂ (G.P.H.)
Takla Lake, 20.XII.37, ex *Tamiasciurus h. columbiensis*, 5 ♀ (J.F.S.F.)
Tatla Lake, 5.III.41, ex *T. hudsonicus* ssp., 1 ♂, 2 ♀ (G.P.H.)
Tiltzarone Lake, 5.IX.44, ex *T. hudsonicus* ssp., 1 ♀ (J.A.M.)
Timberline Valley, 2.VIII.45, ex *Phenacomys* sp., 1 ♀ (G.C.C.)
Tranquille, 30.VII.33, ex *T. hudsonicus streatori*, 1 ♂ (D.C.)
Vavenby, 20.IV.33, ex *T. hudsonicus streatori*, 1 ♀ (T.K.M.)
Wigwam, ex *T. hudsonicus* ssp. (G.P.H.); 9.VI.39, ex *Citellus c. columbianus*, 1 ♂ (G.P.H.)

Alta.: Banff, 28.V.45, ex *T. hudsonicus* ssp. (I.McT.C.); 3.V.45, ex *Citellus lateralis tescorum*, 1 ♀ (I.McT.C.)
Blackfalds, 23.VI.40, ex *T. hudsonicus preblei*, 4 ♂, 3 ♀ (G.P.H.)
Chipewyan, VI-VIII.45, ex *T. hudsonicus* ssp., 6 ♂, 16 ♀ (W.F.); 27.VII.45, ex *Peromyscus m. borealis*, 1 ♀ (W.F.); 1.IX.45, ex *Falco columbarius*, 1 ♀ (W.F.)
Fidler Point, 21.VIII.45, ex *Tamiasciurus hudsonicus* ssp., 4 ♀ (W.F.)
Jasper Pk., 1.VI.44, ex *T. hudsonicus* ssp., 1 ♂ (I.McT.C.)
Lake Athabaska, ex *T. hudsonicus* ssp., 2 ♀ (W.F.)
Waterton, 24.VI.38, ex *T. hudsonicus richardsonii*, 1 ♂ (G.P.H.)

Sask.: Carlyle Lake, 18.VII.44, ex *T. hudsonicus* ssp., 1 ♀ (W.F.)
Emma Lake, 27.V.40, ex cat, 1 ♀ (L.G.S.)
Goldfields, 6.VIII.45, ex *T. hudsonicus* ssp., 1 ♀ (W.F.)

Ont.: Algoma, 10.IX.35, ex *Mustela v. vison*, 1 ♀ (C.H.D.C.); 8.VIII.35, ex *Mephitis m. mephitis*, 1 ♂ (C.H.D.C.); 19.VIII.35, ex *Peromyscus m. gracilis*, 1 ♀ (C.H.D.C.) 3.VIII.35, ex *Clethrionomys g. gapperi* (C.H.D.C.); VII.35, ex *Tamiasciurus h. hudsonicus* ssp., 28 ♂, 35 ♀ (C.H.D.C.)
Biggar Lake, 27.VIII.32, ex *T. hudsonicus* ssp., 1 ♂ (C.H.D.C.)
Brule Lake, 16.VI.34, ex *T. hudsonicus* ssp., 1 ♂ (C.H.D.C.); 28.VII.34, ex *Blarina brevicauda talpoides*, 2 ♂, 3 ♀ (C.H.D.C.); 3.VII.34, ex man, 1 ♀ (C.H.D.C.)
Kawene, VII.45, ex "chipmunk", 1 ♂ (A.C.B.)
Pottageville, 12.VII.32, ex *Sciurus carolinensis leucotis*, 2 ♂ (C.H.D.C.)

Que.: Lac le Grand Fourche, 25.VIII.34, host not recorded, 1 ♀ (C.R.T.)
St. Anne de Bellevue, ex *T. hudsonicus* ssp., 2 ♂, 1 ♀

N.W.T.: Caribou Island, Great Slave Lake, 26.VI.46, ex *T. hudsonicus* ssp., 1 ♂ (H.T.F.)
Jones Point, Great Slave Lake, 2.VII.46, ex *T. hudsonicus* ssp., 2 ♂, 4 ♀ (W.F.)
Reliance, 16.VII.36, ex *T. hudsonicus* ssp., 1 ♀ (C.H.D.C.)

Specimens examined: large series, of both sexes, including the type ♂ (U. S. N. M.)

MONOPSYLLUS WAGNERI (Baker)

M. wagneri is the dominant flea of deer mice *(Peromyscus maniculatus* ssp.) in many parts of western Canada, particularly in areas at low altitude. While *Peromyscus* occurs also in the sub-alpine regions of the mountains, it is usually infested with other species of fleas.

As mentioned elsewhere, and shown in the keys, three subspecies of *wagneri* are recognizable, all occurring in Canada.

MONOPSYLLUS WAGNERI WAGNERI (Baker)

(Plate XXXVIII, figs. 303, 304; Map 40)

Ceratophyllus wagneri Baker 1904, U. S. Nat. Mus. Proc. 27:387,405-406,448; pl. XV, figs. 3-7. Males from Moscow, Idaho, ex "*Peromyscus leucopus*" (*P. maniculatus* ssp.) and "house mouse" (*Mus musculus*).

Ceratophyllus peromysci Stewart 1928, Can. Ent. 60:148-149; pl. XIII, figs. 1,2. Female from Cortez, Colorado, ex *Peromyscus*. Synonym, fide Stewart (1930:152).

Ceratophyllus wagneri wagneri Baker. Jordan 1929, Nov. Zool. 35:35. From British Columbia.

Monopsyllus wagneri (Baker). Jordan 1933, Nov. Zool. 39:78.

Monopsyllus wagneri wagneri (Baker). Wagner 1936, Can. Ent. 68(9):200. Recorded from Aspen Grove, ex *Peromyscus* and Monte Creek, ex "*Putorius arizonensis*" (*Mustela frenata* ssp.), both in British Columbia.

Megabothris wagneri (Baker). I. Fox 1940, Fleas of Eastern U. S. pp. 71-72; pl. XIX, figs. 96,97.

Monopsyllus wagneri wagneri (Baker). Holland 1942, Murrelet 23(2):60. Recorded from Penticton, B.C., ex *Reithrodontomys megalotis nigrescens*.

This, the type subspecies, is geographically restricted to the territory lying between the Cascade Mountains in the west and the foothills of the Rockies (east slopes) in Alberta in the east. To the west it is replaced by *M. w. ophidius*, which is the most readily recognized of the three subspecies, there being good characters in both sexes for identification. In the east it is replaced by *M. w. systaltus*, to which it is nearer akin. The females may be distinguished by the character of the bursa copulatrix, but the males are almost impossible to determine with certainty, although one may rely upon geographical distribution a great deal.

All fleas of the *wagneri* complex seem to be commonest during the summer months.

New Canadian records:

B.C.: Birken, 29.VII.39, ex *Peromyscus m.* ssp., 2 ♂, 6 ♀ (L.C.C.)
Bouchie Lake, ex *Peromyscus m.* ssp. (J.A.M.)
Cawston, 25.V.45, ex *Peromyscus m. artemisiae*, 3 ♂, 3 ♀ (G.P.H.)
Chapmans, ex *Peromyscus m.* ssp. (G.P.H.)
Copper Creek, 8.V.42, ex *Peromyscus m.* ssp., 7 ♂, 16 ♀ (G.P.H.); 8.V.42, ex *Phenacomys i. intermedius*
Eagle Pass, 8.V.46, ex *Peromyscus m. artemisiae*, 15 ♂, 27 ♀ (G.P.H.)
Goodfellow Ck., 18.VIII.45, ex *Peromyscus m.* ssp., 2 ♂ (G.C.C.)

Kamloops, 14.III.41, ex *Peromyscus m. artemisiae*, 4♂ (G.P.H.); IV.44, ex *P. m. artemisiae*, 26♂, 27♀ (G.P.H.); 19.VI.41, ex *Mustela frenata* ssp., 2♂, 1♀ (G.P.H.)
Kelowna, 8.IV.40, ex *Peromyscus m. artemisiae*, 5♂, 14♀ (G.P.H.)
Kinbasket Lake, 4.VIII.43, ex *Peromyscus m.* ssp., 10♂, 10♀ (G.P.H.); 9.VIII.44, ex *Peromyscus m.* ssp., 14♂, 19♀ (G.P.H.); 6.VIII.43, ex *Microtus longicaudus mordax*, 1♂ (G.P.H.)
Knutsford, 21.III.40, ex *Peromyscus m. artemisiae*, 8♂, 5♀ (G.P.H.)
Lac la Hache, ex *Peromyscus m.* ssp. (G.C.C.)
Nicola, 27.III.40, ex *Peromyscus m. artemisiae*, 3♂, 2♀ (G.P.H.)
Nulki Lake, ex *Peromyscus m.* ssp. (J.A.M.)
Okanagan Landing, 10.VIII.40, ex *Peromyscus m. artemisiae*, 2♂ (G.P.H.)
Paradise Mine, 25.VIII.44, ex *Peromyscus m. artemisiae*, 3♀ (G.P.H.); 27.VIII.44, ex *Clethrionomys gapperi saturatus*, 1♂ (G.P.H.)
Penticton, IV.42, ex *Peromyscus m. artemisiae*, 1♂ (G.P.H.)
Quesnel, 17.VIII.43, ex *Peromyscus m. borealis*, 2♂, 3♀ (M.S.)
Rayleigh, ex *Peromyscus m. artemisiae* (G.P.H.)
Redstone, 2.VI.41, ex *Peromyscus m.* ssp., 1♂, 2♀ (G.P.H.)
70-Mile House, 15.VI.44, ex *Peromyscus m. artemisiae*, 1♂, 4♀ (G.P.H.)
Tulameen, 7.V.42, ex *Peromyscus m.* ssp., 17♂, 28♀ (G.P.H.)
Vavenby, 9.IV.40, ex *Peromyscus m.* ssp., 1♂ (J.D.G.); 16.IV.40, ex *Mustela frenata* ssp., 1♂ (J.D.G.); VIII.43, ex child, 1♂ (T.K.M.)
Williams Lake, IV.44, ex *Peromyscus m.* ssp., 33♂, 14♀ (G.P.H.)

Alta.: Banff, 14.VII.39, ex *Peromyscus m. borealis*, 9♀ (J.D.G.)
Waterton, 24.VI.38, ex *Mustela erminea cicognani*, 7♂, 9♀ (G.P.H.)

Specimens examined: Large series, of both sexes, including the type ♂ (U. S. N. M.)

MONOPSYLLUS WAGNERI OPHIDIUS (Jordan)

(Plate XXXVIII, figs. 305, 306; Map 40)

Ceratophyllus wagneri ophidius Jordan 1929. Nov. Zool. 35:36; pl. II, fig. 20. Both sexes from San Francisco (type locality) and San Mateo, California, ex "*Putorius xanthogenys*" (*Mustela frenata x.*).

This subspecies is apparently confined to the Pacific coast region, west of the Cascades, from California, north through Oregon and Washington, and now is recorded for the first time in Canada, from coastal British Columbia, including Vancouver Island. Just how far up the coast it occurs is not known at present.

New Canadian records:

B.C.: Allison Pass, 28.VII.45, ex *Peromyscus m.* ssp., 1♂, 1♀ (G.C.C.)
Alta Lake, ex *Peromyscus m. oreas*, 2♀ (I.McT.C.)
Chapmans, 30.IX.42, ex *Peromyscus m.* ssp., 1♀ (G.P.H.)
Chilliwack, 19.V.43, ex *Peromyscus m. austerus*, 1♀ (J.D.G.)
Cultus Lake, 6.VII.45, ex *Peromyscus m. austerus*, 4♂, 2♀ (G.P.H.)
Departure Bay, V. I., 10.IX.44, ex *Peromyscus m.* ssp., 1♂, 4♀ (H.D.F.)
Forbidden Plateau, V. I., 20.VIII.43, ex *Peromyscus m. interdictus*, 1♀ (G.C.C.)
Gleneagles, ex *Peromyscus m. austerus* (J.D.G.)
Harrison Bay, 4.V.40, ex *Peromyscus m. austerus*, 1♂, 9♀ (G.P.H.)
Nanaimo, V.I., 7.VIII.44, ex *Sorex* sp., 1♀ (H.D.F.); 5.VIII.44, ex *Peromyscus m.* ssp., 4♀ (H.D.F.)
Silver Creek, 26.IV.40, ex *Peromyscus m. oreas*, 7♂, 7♀ (J.D.G.); 31.V.41, ex *P. m. oreas*, 4♂, 5♀ (J.D.G.); 31.VI.41, ex *Sorex* sp., 1♂ (J.D.G.); 26.IV.42, ex *P. m. oreas*, 13♂, 7♀ (J.D.G.)
Vancouver, 27.IV.33, ex *Peromyscus m. austerus*, 1♂, 1♀ (G.J.S.); 1.XI.40, ex *Spilogale gracilis olympica*, 1♂, 1♀ (I.McT.C.)

Specimens examined: 53♂, 60♀.

MONOPSYLLUS WAGNERI SYSTALTUS (Jordan)

(Plate XXXVIII, figs. 307, 308; Map 40)

Ceratophyllus wagneri systaltus Jordan 1929, Nov. Zool. 35:35; pl. II, fig. 19. Both sexes from "Blackfalls" (Blackfalds type locality) Alta., ex mouse, probably *Peromyscus* and Red Deer, Alta., ex "*Peromyscus arcticus*" (*P. maniculatus borealis*).

Monopsyllus wagneri systolus (sic!) Jordan. Wagner 1936, Can. Ent. 68(9):200.

This subspecies is of wide distribution in Alberta and Saskatchewan, extending northwards into territory bordering the range of *M. thambus* (Jordan). An extensive series from Alberta and Saskatchewan shows the short bursa copulatrix character (fig. 308) very consistently.

New Canadian records:

Alta.: Calgary, VII.43, ex *C. r. richardsonii*, 2♂, 1♀ (S.P.Crew)
Chipewyan, 12.VI.45, ex *Peromyscus m. borealis*, 1♂, 2♀ (W.F.)
Elkwater, 7.VI.40, ex *Zapus princeps minor*, 1♀ (G.P.H.); 7.VI.40, ex *P. m. osgoodi*, 6♂, 2♀ (G.P.H.)
Lethbridge, 11.VI.40, ex *Peromyscus m. osgoodi*, 5♂, 4♀ (G.P.H.)
Manyberries, 4.VI.40, ex *Peromyscus m. osgoodi*, 4♂, 5♀ (G.P.H.)
Medicine Hat, 6.VI.40, ex *Peromyscus m. osgoodi*, 3♂, 10♀ (G.P.H.)
Milk River, 26.V.40, ex *Peromyscus m. osgoodi*, 1♂, 13♀ (G.P.H.)
Stanmore, V.40, ex *C. r. richardsonii*, 4♂ (S.P.Crew); 9.VII.40, ex *Speotyto*, 1♂ (S.P.Crew)
Sunnynook, 8.VII.40, ex *C. r. richardsonii*, 1♀ (S.P.Crew)
Waterways, ex *Peromyscus m. borealis* (W.F.)

Sask.: Carlyle Lake, 25.VI.42, ex *Peromyscus m. borealis*, 1♂, 2♀ (G.P.H.); 26.VI.42, ex *Thomomys talpoides rufescens*, 1♀ (G.P.H.)
Ceylon, 4.VII.42, ex *Peromyscus m. osgoodi*, 3♀ (G.P.H.); 4.VII.42, ex *Onychomys leucogaster missouriensis*, 4♂, 9♀ (G.P.H.)
Dundurn, 28.V.43, ex *C. r. richardsonii*, 1♂ (S.P.Crew)
Eastend, 11.VII.42, ex *Peromyscus m. osgoodi*, 1♂, 6♀ (G.P.H.)
Estevan, 21.VII.42, ex *Mus musculus*, 1♀ (G.P.H.); 28.VI.42, ex *Peromyscus m. osgoodi*, 3♂, 4♀ (G.P.H.); 23.VII.42, ex *Microtus p. drummondi*, 1♀ (G.P.H.)
Indian Head, 31.VIII.44, ex *Peromyscus m.* ssp., 3♀ (S.M.)
Maple Creek, 13.VII.42, ex *Peromyscus m. osgoodi*, 3♀ (G.P.H.)
Regina, 18.IX.43, ex *Clethrionomys gapperi* ssp., 2♀ (W.F.); 25.IX.43, ex *Peromyscus* sp., 1♂ (W.F.)
Rock Glen, 10.IX.42, ex *Onychomys l. missouriensis*, 1♀ (W.F.)
Saskatoon, 3.X.42, ex *Peromyscus m.* ssp., 1♀ (W.F.)
Shepleys Is., 11.X.43, ex *Peromyscus m.* ssp., 1♂ (W.F.); 11.X.43, ex *Clethrionomys gapperi* ssp., 1♀ (W.F.)
Val Marie, 5.VII.42, ex *Peromyscus m. osgoodi*, 6♂, 9♀ (G.P.H.); 8.VII.42, ex *Mus musculus*, 1♂, 2♀ (G.P.H.)

Specimens examined: 56♂, 118♀, including 10♂ and 4♀ topotypes.

NOSOPSYLLUS Jordan

Genotype: *Pulex fasciatus* Bosc d'Antic 1801 (Palaearctic: now cosmopolitan)
Nosopsyllus Jordan 1933, Nov. Zool. 39:76-77.

Eyes well developed. Fore femur with a number of lateral setae. Inside of bases of mid and hind coxae without long thin setae.

Males with sternum VIII vestigial (Pl. XXXIX, fig. 310). A narrow sinus in ventral arm of sternum IX. No heavily pigmented spines on F.

Females with long sclerotized duct on bursa copulatrix, the upper end of which is rolled up in a spiral (fig. 311). Spermatheca with large head, strongly rounded above; tail narrower, and curled up around the head.

A palaearctic genus, containing several species, mostly normal parasites of *Rattus* spp. Two species have become introduced to North America. One of these, *N. londiniensis* (Rothschild) has been recorded only from California. The other, *N. fasciatus* (Bosc d'Antic) is more widespread, and well known in Canada.

NOSOPSYLLUS FASCIATUS (Bosc d'Antic)

(Plate XXXIX, figs. 309, 310, 311; Map 34)

Pulex fasciatus Bosc d'Antic 1801, Sci. Soc. Philom. Bul. 2:156.
Ceratophyllus fasciatus (Bosc). Wagner, 1898, Horae Soc. Ent. Ross. 31:559-562; pl. VIII, figs. 7,10.
Ceratophyllus californicus Baker 1904, U. S. Nat. Mus. Proc. 27:387,395-396,440; pl. XVII, figs. 5-8. Synonym, fide Jordan (1929:33).
Ceratophyllus oculatus Baker, 1904, U. S. Nat. Mus. Proc. 27:387; 396-397,445; pl. XIX, figs. 10-14. Synonym, fide Jordan (1929:33).
Ceratophyllus canadensis Baker 1904, U. S. Nat. Mus. Proc. 27:388; 407-408,440; pl. XX, figs. 1-4. Female, from Ottawa, Canada. Synonym, fide Jordan (1929:33).
Ceratophyllus fasciatus (Bosc). Jordan and Rothschild 1921, Ectoparasites I:178-184; text-figs. 165 a, b, 166.
Nosopsyllus fasciatus (Bosc). Jordan 1933, Nov. Zool. 39:76-77.
Neopsylla (sic!) *fasciatus* (Bosc). Spencer 1936, Ent. Soc. B. C. Proc. 32:14. Recorded from British Columbia, ex Norway rat.
Nosopsyllus fasciatus (Bosc). Holland 1941, Ent. Soc. B. C. Proc. 37:2-4. Tabulation of sylvatic plague survey crew collections for 1939 in British Columbia.
Nosopsyllus fasciatus (Bosc d'Antic). Holland 1944, Ent. Soc. B. C. Proc. 41:11.
Nosopsyllus fasciatus (Bosc). Baker 1946, Journ. Expt. Med. 84(1):47. Recorded from Grosse Isle, Quebec, ex *Microtus p. pennsylvanicus*.

N. fasciatus, the European rat flea, is well established in Canada, where its occurrence is governed by the distribution of introduced European and Asiatic rats. The black rat, *Rattus r. rattus* and the roof rat, *Rattus r. alexandrinus* are still comparatively rare, and are chiefly confined to seaport towns. However, the common brown or Norway rat, *Rattus norvegicus*, is (unfortunately) well established over considerable territory, and quite definitely increasing. It is very common in the lower Fraser Valley of British Columbia, and all along the Pacific coast, including Vancouver Island and probably the Queen Charlottes, where it has followed man. While it favours garbage dumps, warehouses, restaurants and human habitations, it is not entirely dependent upon man by any means. The writer has seen these rats running wild in the woods near Chilliwack, in Stanley Park (Vancouver) and in the famous Butchart gardens in Victoria.

R. norvegicus does not appear to have become established in the interior of British Columbia to any extent, or in Alberta, but the sanitation authorities of Saskatchewan have noted a steady influx of these undesirable rodents during the last two decades. They have entered the southeast of that province, from Manitoba, and are migrating and spreading to the west and north, following the railroads, and becoming more and more securely settled in the grain elevators and garbage dumps of southern prairie towns.

At Estevan, Sask., the writer noted them in large numbers in a garbage dump just south of the town, and within ten miles of the plague focus discovered in North Dakota in 1941, in association with the Richardson ground squirrel, *Citellus r. richardsonii* (Holland 1944:5-12). In fact, ground squirrel fleas *(Oropsylla rupestris)* were collected on the rats here. Conversely, *Nosopsyllus fasciatus*, the rat flea, was found on native white-footed mice at Regina.

Rats appear to be well established in most of the large centres of population in Eastern Canada, especially seaport towns, and it may be assumed that the flea *N. fasciatus* is coincident with their distribution.

New Canadian records (from plague survey files):

B.C.: Burnaby, ex *Rattus norvegicus*
Chilliwack, ex *R. norvegicus* and *Sorex* sp.
Courtenay, V.I., ex *R. norvegicus*
Duncan, V.I., ex *R. norvegicus*
Nanaimo, V.I., ex *R. norvegicus*
Ocean Falls, ex *R. norvegicus*
Port Alberni, V.I., ex *R. norvegicus*
Port Moody, ex *R. norvegicus*
Powell River, ex *R. norvegicus*, "mice", and *Tamiasciurus douglassi mollipilosus*
Prince Rupert, ex *R. norvegicus*
Roberts Creek, ex *R. norvegicus*
Steveston, ex *R. norvegicus*
Surrey, ex *R. norvegicus*
Victoria, V.I., ex *R. norvegicus*
White Rock, ex *R. norvegicus*

Sask.: Estevan, ex *Rattus norvegicus*
Regina, ex *Peromyscus maniculatus* ssp.
Saskatoon, ex *R. norvegicus*

Ont.: Ottawa, ex *R. norvegicus*

Que.: Kirk's Ferry, ex "rat"

Specimens examined: large series, of both sexes, including the types (♀) of "*Ceratophyllus canadensis*" and "*C. californicus*" (U. S. N. M.)

Subfamily D. LEPTOPSYLLINAE Rothschild 1915

The genera included here in the Leptopsyllinae have usually, in the past, been associated with the Hystrichopsyllidae rather than the Ceratophyllidae. This has been due principally to difference of opinion as to the importance of the fracticipit head-capsule character. However, the presence of apical spinelets

on the posterior margin of the metanotum, the flat pygidium, and the presence of an apodemal rod, extending anteriorly from the angle of sternum IX, as well as other characters, indicate them to be fundamentally more closely akin to the latter family, as considered here.

Head "helmet-shaped" (figs. 312, 316), with a distinct interantennal suture evident in both sexes. Some of the setae along the frontal margin modified into "spiniforms". Eyes much reduced. A vertical genal ctenidium of two or four spines in the North American genera (many more spines in some Old World genera).

Hind tibia (fig. 313) with an even, comb-like row of strong bristles along the posterior margin. No spinelets on inside of hind coxae.

The subfamily is represented by two genera in North America, one introduced, one indigenous.

LEPTOPSYLLA Jordan and Rothschild

Genotype: *Pulex musculi* Duges 1832 (a synonym of *Pulex segnis* Schönherr 1811 (palaearctic)

Ctenopsyllus Kolenati 1863, Horae Soc. Ent. Ross. 2:37.

Leptopsylla Jordan and Rothschild 1911, Nov. Zool. 18:85 (=*Ctenopsyllus* Kolenati 1863, preoccupied by *Ctenopsyllus* Kolenati 1857).

Leptopsylla Jordan and Rothschild. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:92-93.

In addition to the characters given for the subfamily—; two heavily pigmented spine-like setae at frontal angle. Genal ctenidium of four well developed spines. Four lateral and one proximal submedian pair of plantar bristles on all tarsi V.

There has been controversy over the name *Leptopsylla* Jordan and Rothschild in preference to *Ctenopsyllus* Kolenati. Ewing and Fox (1943:93) review the situation.

Palaearctic. One species is present in North America, where it was introduced many years ago with invasions of domestic rats and mice.

MAP 41

Ceratophyllidae:Leptopsyllinae. Locality records of *Leptopsylla segnis* (Schönherr), *Peromyscopsylla hesperomys pacifica* n. ssp., and *P. ravalliensis* (Dunn).

LEPTOPSYLLA SEGNIS (Schönherr)

(Plate XXXIX, figs. 312, 313, 314, 315; Map 41)

Pulex segnis Schönherr 1811, Kong. Vet. Acad. Nya Handl. 32:98-101, with figs.

Ctenopsyllus segnis (Schönherr). I. Fox 1940, Fleas of Eastern U. S. pp. 88-90; pl. 24, figs. 122-126.

Ctenopsyllus segnis (Schönherr). Holland 1941, Ent. Soc. B. C. Proc. 37:13. Recorded from Kelowna, British Columbia, ex *Mus musculus*.

This introduced flea is well known in various areas of the United States, where it occurs on its true host *(Mus musculus)* as well as on *Rattus*. While many hundreds of domestic mice and rats have been collected and examined for parasites in Canada, oddly enough, there have been no further records of this flea. Specimens examined: 4♂, 4♀.

PEROMYSCOPSYLLA I. Fox

Genotype: *Ctenopsyllus hesperomys* Baker 1904
Peromyscopsylla I. Fox 1939, Ent. Soc. Wash. Proc. 41:47-48.
Peromyscopsylla I. Fox. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:90.

Like *Leptopsylla* but with two genal spines instead of four. These spines vary in relative size, according to species. Anterior margin of head with a series of setae of which two to four at the frontal angle are somewhat thickened and more heavily pigmented, and usually referred to as "spiniforms". Hind tibia with comb-like bristles as in *Leptopsylla.*

Holarctic (in the original description considered as only Nearctic). At present about a dozen species and subspecies have been described from North America, although there is some doubt as to the validity of one or two of them. In Canada, five species are known. These may be determined by the following key:

Key to the Canadian species of *Peromyscopsylla*

1. Upper genal spine longer than lower 2
   Lower genal spine as long as, or longer than, upper 4
2. Genal process short and concealed beneath upper genal spine (Pl. XL, fig. 328). Two frontal spiniforms .... *hamifer hamifer*
   Genal process visible above, and extending more distad than upper genal spine (figs. 316, 319, 325, 331). Three or four frontal spiniforms 3
3. Saskatchewan and westward.
   ♂. With about seven longish setae on posterior margin of sternum VIII (fig. 332)
   ♀. Normally three antepygidial setae .... *selenis*
   Ontario and eastward.
   ♂. About two long setae on posterior margin of sternum VIII (fig. 326)
   ♀. Normally four antepygidial setae .... *catatina*
4. Frontal spiniforms three (fig. 319).
   ♂. Usually two long setae at upper apical lobe of sternum VIII (fig. 320)
   ♀. Sternum VII very deeply incised (fig. 324 a-e) .... *hesperomys pacifica* n. ssp.
   Frontal spiniforms typically four (fig. 316).
   ♂. About four long setae at upper apical lobe of sternum VIII (fig. 317)
   ♀. Sternum VII highly variable in contour; moderately to deeply incised (fig. 318 a-j) .... *ravalliensis*

MAP 42

Ceratophyllidae:Leptopsyllinae. Locality records of *Peromyscopsylla catatina* (Jordan), *P. hamifer hamifer* (Rothschild) and *P. selenis* (Rothschild).

PEROMYSCOPSYLLA CATATINA (Jordan)

(Plate XL, figs. 325, 326, 327; Map 42)

Leptopsylla catatina Jordan 1928, Nov. Zool. 34; 186-187: text-fig. 10. Female, from Rolling Rock Club, Ligonier, Penna., ex *Didelphis virginiana*.

Leptopsylla catatina Jordan. Jordan 1929, Nov. Zool. 35:171; text-fig. 6. Male described, from Adirondack Mts., New York, ex *Parascalops breweri*, *Blarina brevicauda* and *Microtus pennsylvanicus*.

Peromyscopsylla catatina (Jordan). I. Fox 1940, Fleas of Eastern U. S. pp. 87-88; pl. XXII, figs. 110,114,115.

Peromyscopsylla catatina (Jordan). Baker 1946, Journ. Expt. Med. 84(1):47. Recorded from Grosse Isle, Que., ex *Microtus p. pennsylvanicus*. Err. det. see *P. h. hamifer*.

The species appears to be confined to eastern North America, where it is found on a variety of hosts.

New Canadian records:

Ont.: Algoma, 3.VIII.35, ex *Microtus c. chrotorrhinus*, 2♂, 1♀ (C.H.D.C.); 22.VIII.35, ex *Tamiasciurus h. hudsonicus*, 1♂ (C.H.D.C.); IX.35, ex *Napaeozapus insignis frutectanus*, 2♂, 1♀ (C.H.D.C.); 5.IX.35, ex *Clethrionomys g. gapperi* ssp. 1♂ (C.H.D.C.)

Brule Lake, Algonquin Park, 29.VIII.45, ex *Clethrionomys gapperi* ssp., 1♂, 1♀ (C.D.F.)

Specimens examined: 7♂, 3♀.

PEROMYSCOPSYLLA HAMIFER HAMIFER (Rothschild)

(Plate XL, figs. 328, 329, 330; Map 42)

Ctenopsyllus hamifer Rothschild 1906. Can. Ent. 38:324-325; text-fig. 44. Male, from "Blackfalls" (Blackfalds), Alta., ex *Mustela* sp.

Leptopsylla hamifer hamifer (Rothschild). Jordan 1937, Nov. Zool. 40:265-266.

Leptopsylla hamifer hamifer (Rothschild). Jordan 1939, Nov. Zool. 41:319-320; text-fig. 271. Compared with *L. h. longiloba*. Sternum VII figured.

Peromyscopsylla catatina (Jordan). Baker 1946, Journ. Expt. Med. 84(1):47. Recorded under this name from Grosse Isle, Que., ex *Microtus p. pennsylvanicus*. Author's note: erroneous determination. Major Traub showed me the specimens on which this record was based. They are undoubtedly *hamifer* ssp.

P. hamifer is distinguished from all other known (Nearctic) members of the genus by the fact that it bears but two frontal spiniforms; the concealment of the genal process; and the apically dilated moveable process of the clasper in the male. (In all other species, this structure is more or less straight on its anterior margin, and semicircular on the posterior margin). The subspecies *P. h. vigens* occurs in Montana, and may yet be found in southern Canada. *P. h. longiloba* (known only from females) was collected at Valdez Creek and Fairbanks, Alaska. It too may occur in Canada, in the far north. The specimens recorded here (tentatively) as belonging to the type subspecies should be compared with the types in the British Museum, as they may be racially distinct, representing an undescribed subspecies.

New Canadian records:

Ont.: Charlton, 18.XII.34, ex *Mustela erminea* ssp., 1♂ (E.D.)

Smoky Falls, Kapuscasing, 11.XI.37, ex *Microtus p. pennsylvanicus*, 1♀ (R.V.W.)

Specimens examined: 3♂, 3♀.

PEROMYSCOPSYLLA HESPEROMYS PACIFICA new subspecies

(Plate XL, figs. 319, 320, 321, 324 a-e; Map 41)

A series of nine pairs of fleas, all collected from *Peromyscus* in various localities in the southern coastal region of British Columbia, while very close to *P. hesperomys* (Baker), known only from the eastern United States, show sufficiently constant differences in both sexes to warrant separation as a western subspecies. A pair of these fleas was submitted to Dr. Karl Jordan, to be compared with specimens of true *hesperomys* in the Museum at Tring. The differences pointed out by Dr. Jordan are found to be uniform in the series in the collection of the writer.

Somewhat smaller than *P. h. hesperomys* (about one-fifth smaller). Three (rarely four) of the setae along the frontal margin shortened and pigmented, becoming "spiniforms". Chaetotaxy of remainder of pre-frontal region as in fig. 319.

Male. Moveable process of clasper a little less than twice as long as broad (holotype 28.5:14; paratypes from 31:17-27:14, average proportions 29.05:15.67). In *P. h. hesperomys* the moveable process is more than twice as long as broad (three males from Ithaca, N.Y., are 40:17, 42:17, and 41.5:17 and with the tip somewhat broader (fig. 322). Sternum VIII more deeply sinuate in the new subspecies, the upper lobe bearing normally two (rarely three) long setae, rather than three or four as in true *hesperomys*. The lower lobe may have one or two subapical setae on either side. Details of sternum IX, etc., as shown in fig. 320. Normally three antepygidial setae on each side. Rarely three on one side and four on the other.

Female. Sternum VII deeply sinuate (fig. 324 a-e), the upper lobe being proportionately broader than is usual in true *hesperomys*. The lower lobe is rounded at the apex, whereas in *P. h. hesperomys* it is normally truncate-sinuate (fig. 324 f). Four antepygidial setae on each side.

Holotype male from the University of British Columbia campus, Vancouver (type locality), 3.X.43, ex *Peromyscus maniculatus austerus* (type host), coll. H. D. Fisher. Allotype female, same locality and host data, 31.III.40, coll. G. J. Spencer, No. 5719 in the Canadian National Collection, Ottawa.

Paratypes: 1♂, 5♀, same locality and host data, 31.III.40 (G.J.S.), 11.X.43, (J.H.), 29.I.44, (H.D.F.), 24.XI.44, (H.D.F.), 20.I.45, (H.D.F.)

2♂, 1♀ Harrison Bay, British Columbia, 3.XI.40, ex *Peromyscus m. austerus* (G.P.H.)

1♂, Mariwood Lake, Vancouver Island, B.C., 1.IX.43, ex *Peromyscus m. interdictus* (G.C.C.)

1♀, Mt. Seymour (near Vancouver), B.C., 27.VI.44, ex *Peromyscus m. oreas* (G.P.H.)

4♂, 1♀, Silver Creek (near Hope), B.C., 31.V.41, ex *Peromyscus m. oreas* (J.D.G.)

Examination of two pairs of paratypes of *Peromyscopsylla hemisphaerium* Stewart (described 1940, from Monterey Co., California) leads the writer to believe that it too should be considered as a subspecies of *hesperomys*. Chaetotaxy and other essential character tally well. It is smaller again than *P. h. pacifica*, and the finger (F) still smaller and slightly broader in proportion to length (22:12 in both specimens, see fig. 323). In the females, the sinus of sternum VII appears to be shallower, and with the ventral lobe somewhat truncate as in *P. h. hesperomys* (fig. 324 g-h). Hubbard (1940) has recorded "*hesperomys*" from Washington, Oregon and California. These specimens should be checked with *hemisphaerium* and *pacifica*.

PEROMYSCOPSYLLA RAVALLIENSIS (Dunn)

(Plate XXXIX, figs. 316, 317, 318; Map 41)

Ctenopsyllus ravalliensis Dunn 1923, Pub. Hlth. Repts. 38:2768:2770,2775. Both sexes from Tin Cup Creek and Spoon Creek, S. W. of Darby, Montana, ex *Neotoma cinerea* ssp.

Ctenopsyllus rawailliensis (sic!) Dunn and Parker. Wagner 1936, Can. Ent. 68(9):205; pl. II, fig. 10. Recorded one female from Vavenby, B.C., ex *Neotoma cinerea occidentalis*. Sternum VII and spermatheca figured.

Woodrats *(Neotoma)* appear to be the true hosts of this species. We have a small series of both sexes from British Columbia, all from *Neotoma*, or other mammals collected in rockslides frequented by woodrats. There is apparently great variation in the contour of sternum VII in the female (fig. 318 a-j). Both sides of the specimen studied by Wagner (1936) are shown too, for comparison (fig. 318, i and j). The species is very close to *hesperomys*.

New Canadian records:

B.C.: Kinbasket Lake, 7.VIII.43, ex *Neotoma cinerea* ssp., 1♂, 2♀ (G.P.H.); 12.VIII.44, ex *Neotoma cinerea* ssp., 1♂, 3♀ (G.P.H.); 9.VIII.44, ex *Peromyscus maniculatus* ssp., 1♀ (G.P.H.)

Paradise Mine, 26.VIII.44, ex *Neotoma cinerea occidentalis*, 2♂ (G.P.H.)

Sullivan River, 13.VIII.44, ex *Ochotona princeps* ssp., 2♂ (G.P.H.)

Specimens examined: 6♂, 7♀, plus a series of 3♂ and 7♀ from Montana, Idaho and Colorado, loaned by Wm. L. Jellison.

PEROMYSCOPSYLLA SELENIS (Rothschild)

(Plate XL, figs. 331, 332, 333; Map 42)

Ctenopsyllus selenis Rothschild 1906, Can. Ent. 38:322-324, text-fig. 43. Male from Horse Creek, Upper Columbia Valley, British Columbia, ex "*Peromyscus canadiani*" (*Peromyscus maniculatus* ssp., probably *borealis*) and "*Microtus drummondi*" (*M. pennsylvanicus d.*); Balckfalds, Alta., ex "kangaroo mouse" (*Zapus* sp.). Females from Kicking Horse Canyon, B. C., ex "*Evotomys gapperi*" (*Clethrionomys gapperi saturatus*) and Red Deer, Alta., ex "*Ecotomys gapperi*" (*Clethrionomys g. loringi*).

This appears to be the commonest species of the genus in northwestern North America. The preferred hosts are mice, especially microtines. It occurs most commonly in humid forest areas, especially at high altitude. It appears to be the commonest flea of mice in "alpine meadows".

New Canadian records:

B.C.: Allison Pass, 28.VIII.45, ex *Microtus* sp., 1 ♂ (G.C.C.)
Beavermouth, 29.I.41, ex *Martes americana* ssp., 1 ♀ (P.B.)
Begbie Mt. (7000′), 8.VIII.41, ex *Clethrionomys gapperi*, 2 ♂, 6 ♀ (G.P.H.)
Berg Lake, Mt. Robson (5500′), 25.VII.44, ex *Microtus longicaudus mordax*, 1 ♂, 2 ♀ (G.P.H.)
Cultus Lake, 6.VII.45, ex *Microtus oregoni serpens*, 2 ♂ (G.P.H.)
Goodfellow Creek, 15.VIII.45, ex *Microtus* sp., 1 ♂, 2 ♀ (G.C.C.)
Field, 11.VIII.44, ex *Clethrionomys gapperi saturatus*, 4 ♂, 6 ♀ (J.H.); 11.VIII.44, ex *Phenacomys intermedius*, 2 ♀ (J.H.); 13.VIII.44, ex *Microtus l. mordax*, 1 ♀ (J.H.)
Gleneagles, 28.IV.40, ex *Peromyscus m. austerus*, 1 ♂ (J.D.G.)
Kastburg Creek, 27.IX.38, ex *Clethrionomys gapperi* ssp., 1 ♀ (J.F.S.F.)
Kinbasket Lake, 4.VIII.43, ex *Sorex* sp., 2 ♀ (G.P.H.); 4.VIII.43, ex *Peromyscus maniculatus* ssp., 2 ♂ (G.P.H.); 9.VIII.44, ex *Microtus l. mordax*, 1 ♂, 1 ♀ (G.P.H.); 14.VIII.44, ex *Clethrionomys gapperi* ssp., 1 ♀ (G.P.H.)
Lac la Hache, 12.X.46, ex *Clethrionomys gapperi* ssp., 1 ♀ (G.P.H.)
Manning Park, VIII.45, ex *Peromyscus m.* ssp., 1 ♂ (G.C.C.); 21.VII.45, ex *Eutamias* sp., 1 ♀ (G.C.C.)
Mt. Seymour, 27.VI.44, ex *Clethrionomys gapperi* ssp., 1 ♀ (G.P.H.)
Paradise Mine (8000′), 25.VIII.44, ex *Microtus l. mordax*, 6 ♂, 10 ♀ (G.P.H.); 26.VIII.44, ex *Phenacomys i. intermedius*, 1 ♂ (G.P.H.)
Revelstoke, 27.IX.45, ex *Microtus l. mordax*, 1 ♀ (G.P.H.)
Tenquille Lake, 30.VII.45, ex *Clethrionomys gapperi* ssp., 2 ♂, 5 ♀ (G.P.H.)
Tetana Lake, 13.IX.38, ex *Clethrionomys gapperi saturatus*, 1 ♂, 1 ♀ (J.F.S.F.)
Timberline Valley, 5.VIII.45, ex *Microtus* sp., 6 ♂, 3 ♀ (G.C.C.); 2.VIII.45, ex *Phenacomys* sp., 2 ♂, 1 ♀ (G.C.C.)
Vancouver, 14.XI.44, ex *Microtus oregoni serpens*, 1 ♂ (H.D.F.)
West Vancouver, X.40, ex *Rattus norvegicus*, 1 ♂ (F.L.B.)

Alta.: Chipewyan, 31.VIII.45, ex *Clethrionomys gapperi athabascae*, 1 ♂, 5 ♀ (W.F.); 2.IX.45, ex *Clethrionomys gapperi athabascae*, 2 ♂ (W.F.); 30.VIII.45, ex *Microtus* sp., 1 ♂ (W.F.); 26.VIII.45, ex *Peromyscus m. borealis*, 1 ♀ (W.F.); 31.VIII.45, ex *Synaptomys b. borealis*, 2 ♂, 2 ♀ (W.F.)

Sask.: Camsell Portage, 4.VIII.45, ex *Clethrionomys g. athabascae*, 1 ♀ (W.F.)
Emma Lake, 9.VIII.40, ex *Peromyscus maniculatus* ssp., 1 ♂ (L.G.S.)
Goldfields, 24.VII.45, ex *Clethrionomys gapperi* ssp., 2 ♂, 1 ♀ (W.F.)
Oungre, 11.VIII.44, ex *Citellus r. richardsonii*, 1 ♂ (W.F.)

Man.: Aweme, 19.X.13, ex *Clethrionomys gapperi* ssp., 1 ♀ (N.C.)

N.W.T.: Buffalo Lake, 1.IX.46, ex *Clethrionomys g. athabascae*, 3 ♂, 5 ♀ (W.F.)

Specimens examined: 51 ♂, 74 ♀.

Family 5. ISCHNOPSYLLIDAE Wahlgren 1907.

Distinguished from all other fleas by the structure of the head, which has a pair of ventral flaps (genal ctenidia ?) located anteriorly on either side of the oral margin (figs. 334, 337, 345). Clear, unsclerotized area in preantennal region of some genera. No trabecula centralis. Pre- and postantennal regions very definitely separated by an interantennal groove. Eyes vestigial. Segments of clava of antenna well marked; no fusion.

Pronotum with ctenidium of true spines. Mesonotum with pseudosetae under collar. Metanotum with apical spinelets. Anterior abdominal terga with short apical spinelets (fig. 346) or with "false combs" (fig. 338). Two or more rows of setae on typical abdominal terga. Tarsal segments V with four pairs of lateral plantar bristles and a basal submedian pair. Pygidium flat. With or without antepygidial setae.

Male claspers with single moveable process. Tergum and sternum VIII subsequally expanded distally, and variously armed with setae, thus offering some protection to the genitalia. Sternum IX with apodemal rod.

Females with single spermatheca. Stylet present.

The apical spinelets of the metanotum, apodemal rod of sternum IX (♂) and other characters indicate that these fleas have a common ancestry with the Ceratophyllidae, being perhaps most closely akin to the Leptopsyllinae. However, the unique structure of the head as well as the intimate association of all the genera with bats (Chiroptera) probably warrants their status as a separate family.

Four North American genera are recognized. Three of these are known to occur in Canada.

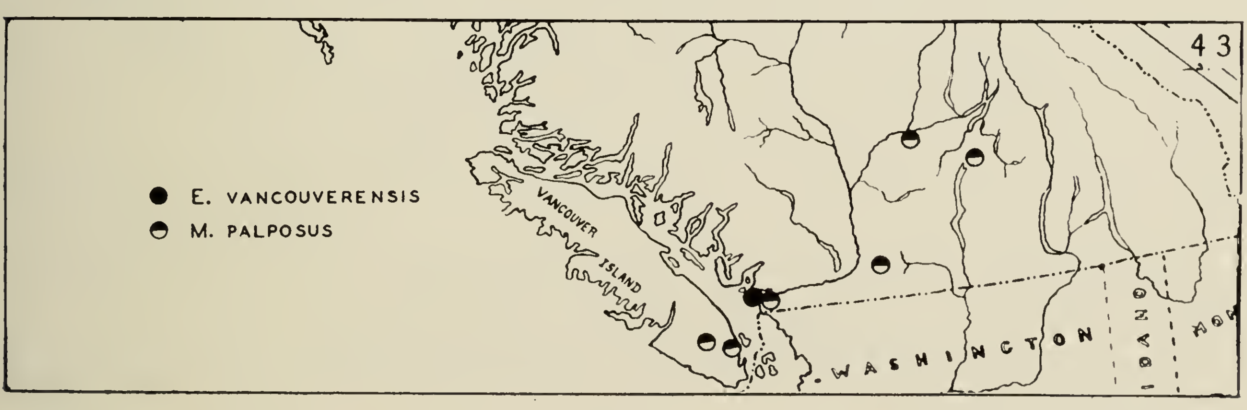
EPTESCOPSYLLA I. Fox

Genotype: *Nycteridopsylla chapini* Jordan 1929
Eptescopsylla I. Fox 1940, Fleas of Eastern U. S., p. 107.
Eptescopsylla I. Fox. Ewing and Fox 1943, U.S.D.A. Misc. Pub. 500:99.

Maxillae acuminate. Ventral flaps acuminate (fig. 334). Abdominal tergum VII bearing a comb (fig. 335). Antepygidial setae lacking.

A strictly nearctic genus, allied to the palaearctic *Nycteridopsylla* Oudemans, which may be distinguished by the presence of combs on the metanotum and abdominal terga I and II as well as on tergum VII.

Two species of *Eptescopsylla* are known, one of which occurs in Western Canada. It is possible that the other, *E. chapini* (Jordan), known at present only from Kentucky and Maryland, may be found in Eastern Canada.



MAP 43
Ischnopsyllidae. Locality records of the bat-fleas *Eptescopsylla vancouverensis* (Wagner) and *Myodopsylloides palposus* (Rothschild).

EPTESCOPSYLLA VANCOUVERENSIS (Wagner)

(Plate XLI, figs. 334, 335, 336; Map 43)

Nycteridopsylla vancouverensis Wagner 1936, Zeitschr. f. Parasitenk. 8(6):654,658; text-figs. 7,8. Both sexes, from Vancouver, British Columbia, ex *Lasionycteris noctivagans*.

Eptescopsylla vancoverensis appears to be a rare species, and is probably confined to the Pacific coast slopes of North America. Aside from additional collections from the type locality and host, there are no new Canadian records at hand.

Specimens examined: 5♂, 11♀ (topotypes).

MYODOPSYLLA Jordan and Rothschild

Genotype: *Ceratopsylla insignis* Rothschild 1903
Myodopsylla Jordan and Rothschild 1911, Nov. Zool. 18:88.
Myodopsylla Jordan and Rothschild. Ewing and Fox 1943, U. S. D. A. Misc. Pub. 500:100.

Preantennal region with a large clear unsclerotized area. Maxillae truncate. Ventral flaps truncate (Pl. XLI, fig. 337). Metanotum and abdominal terga I-VII with false combs, formed by closely grouped stout dorsal setae (fig. 338). antepygidial setae present.

Holarctic. Three valid species and one doubtful one are known at present in North America. Two of these occur in Canada, one of widespread distribution across most of the Dominion, the other apparently confined to British Columbia.

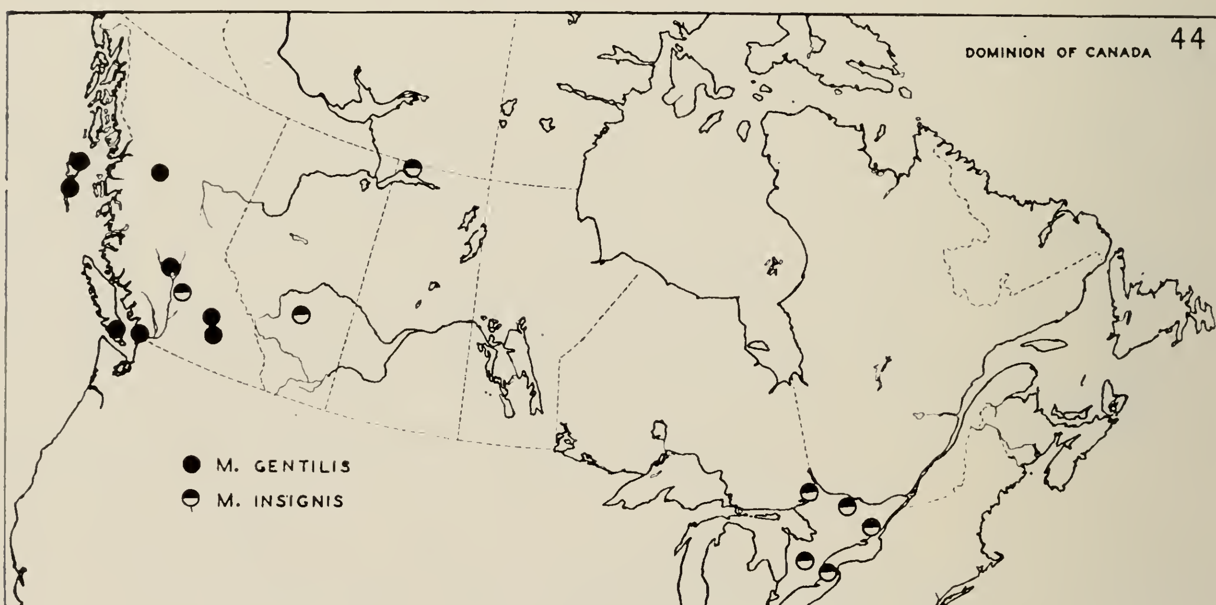
Key to the Canadian species of *Myodopsylla*

Males.

1. F compact and roughly triangular. Clasper with two or three long marginal setae immediately below F (Pl. XLII, fig. 343) . . . . *gentilis*

   F produced apically into a slender process. Posterior margin of clasper with fringe of about six curved, strong setae (fig. 340) . . . . *insignis*

Note: the females of *Myodopsylla* do not appear to have fully reliable distinguishing characters. See discussion of species.



MAP 44

Ischnopsyllidae. Locality records of the bat-fleas *Myodopsylla gentilis* Jordan and Rothschild and *M. insignis* (Rothschild).

MYODOPSYLLA GENTILIS (Jordan and Rothschild)

(Plate XLI, fig. 339; plate XLII, figs. 343, 344; Map 44)

Myodopsylla gentilis Jordan and Rothschild 1921, Ectoparasites 1:152; text-fig. 131. Both sexes from Okanagan Landing, B.C., ex "bat".

Myodopsylla gentilis appears to be a fairly common species, and is well known in the western United States as well as Canada. In Canada it has not been recorded east of the Rocky Mountains. It is most frequently taken on *Myotis* spp.

According to the original description the female of this species is very close to that of *M. insignis* but "the head of the receptaculum seminis appears to be a little shorter and the tail slightly longer than in *insignis*". This character does not appear to be reliable in our material; in fact, sometimes the reverse seems to be the case. As the ranges of the two species overlap in part, definite determinations should not be made on the strength of females alone. The males are very distinct.

New Canadian records:

B.C.: Cowichan Lk., V.I., 3.VI.39, ex *Myotis* sp., 2♂, 12♀ (J.H.)
Duncan, V.I., 4 VI.40, ex *Myotis lucifugus alascensis*, 1♂, 5♀ (I.McT.C.)
Massett, Q.C.I., 10.VII.46, ex *Myotis lucifugus* ssp., 1♀ (C.J.G.)
Moresby Is., Q.C.I., 27.VIII.46, ex *Myotis yumanensis saturatus*, 1♂ (C.J.G.)
Tetana Lake, 3.VI.39, ex *Myotis lucifugus alascensis*, 1♂, 3♀ (J.F.S.F.)
Vancouver, 3.IX.40, ex "bat", 1♂
Vernon, 30.IX.41, ex *Myotis lucifugus alascensis*, 2♂, 1♀ (I.McT.C.)

Specimens examined: 13♂, 27♀.

MYODOPSYLLA INSIGNIS (Rothschild)

(Plate XLI, figs. 337, 338; Plate XLII, figs. 340, 341, 342; Map 44)

Ceratopsylla insignis Rothschild 1903, Nov. Zool. 10:319; pl. 9, figs. 8-10. Both sexes from Waterloo, Ont., ex "*Myode lucifugus*" (*Myotis l.*).

Ceratopsyllus crosbyi Baker 1905, U. S. Nat. Mus. Proc. 29:137. Synonym, fide Ewing and Fox (1943:101).

Myodopsylla subulata Chapin 1919, Bul. Brook. Ent. Soc. 14:55-58. Synonym, fide Jordan and Rothschild (1921:151)

Myodopsylla insignis (Rothschild). Jordan and Rothschild 1921, Ectoparasites 1:151; text-figs. 129,130.

Myodopsylla insignis (Rothschild). Jameson 1943, Journ. Mammal. 24(2):195. Recorded from Welland Co., Ont. ex *Myotis l. lucifugus*

This appears to be one of the commonest and most widely distributed of the North American bat-fleas. In Canada it is known from Ontario to British Columbia.

New Canadian records:

B.C.: Exeter, 30.VII.46, ex "little brown bats", 11♂, 14♀ (L.J.)
Meldrum Creek, VI.46, ex "bat", 1♂, 2♀ (L.J.)

Alta.: Blackfalds, 22.VI.40, ex *Eptesicus fuscus pallidus*, 2♂, 5♀ (G.P.H.)

Sask.: Crackingstone Pt., Lk. Athabaska, 12.VIII.45, ex *Myotis* sp., 2♂, 3♀ (W.F.)

Ont.: Brule Lake, Algonquin Pk., 19.VII.45, ex *Myotis lucifugus*, 3♀ (C.D.F.)
Fletcher, 28.VIII.35, ex *Myotis keeni septentrionalis*, 9♂, 15♀ (E.D.)
Frank's Bay, L. Nipissing, VII.35, ex "bats", 3♂, 3♀ (J.R.D.)
Gananoque, 16.VIII.34, ex "brown bat", 1♂, 3♀; 5.VII.35, ex *Myotis lucifugus*, 5♀: 12.VII.35, ex *Myotis*, sp., 9♂, 24♀ (G.C.T.)
Spencerville, 6.VI.35, ex *Myotis lucifugus*, 1♀ (G.H.H.)

Specimens examined: 52♂, 93♀.

MYODOPSYLLOIDES Augustson

Genotype: *Myodopsylloides piercei* Augustson 1941 (a synonym of *Ceratopsylla palposus* Rothschild 1904)

Myodopsylloides Augustson 1941, S. Cal. Acad. Sci. Bul. 40(2):104.

Like *Myodopsylla*, but lacking false combs on the metanotum and abdomen. Abdominal terga slightly incrassate dorsally, and bearing a few apical spinelets (fig. 346). A Nearctic genus, containing one known species, *M. palposa*, which, up to the present has been erroneously allocated to the genus *Rhinolophopsylla* Oudemans.

Dr. Karl Jordan informs the writer (in litt.) that the species *palposa* does not belong to true *Rhinolophopsylla*, which is apparently strictly palaearctic, but is, in actuality, a *Myodopsylla* without abdominal combs, and that it could, with justification, be placed in a genus by itself. Augustson, in describing *Myodopsylloides piercei*, has provided a suitable name for this genus, but his specific name is a synonym of *M. palposus*.

MYODOPSYLLOIDES PALPOSUS (Rothschild) (new combination)

(Plate XLII, figs. 345, 346, 347, 348; Map 43)

Ceratopsylla palposus Rothschild 1904, Nov. Zool. 11:652-653. Described from the female, collected at "Cowicham, Demeans" (Cowichan, Duncan, V. I.), British Columbia, ex "brown bat".

Rhinolophopsylla palposus Rothschild. Wagner 1936, Can. Ent. 68(9):206. Female recorded from Vancouver, B.C., ex "*Eptesicus f. fuscus*" (*E. f. barnardinus*).

Rhinolophopsylla palposus Rothschild. Wagner 1940, Zeitsch. f. Parasitenk. 11(4):463-464; text-figs. 1,2. Description of male from Kamloops, B.C., ex "*Eptesicus f. fuscus*" (*E. f. barnardinus*).

Myodopsylloides piercei Augustson 1941, S. Cal. Acad. Sci. Bul. 40(2):104-105; pl. 7, figs. 1-5. (New synonym).

Through the courtesy of Dr. C. Andresen Hubbard, the writer has had the opportunity of examining a pair of *M. piercei*, and comparing them with British Columbia specimens of *palposus*. There is no doubt as to the synonymy. The species appears to be confined to extreme western North America.

New Canadian records:

B.C.: Manning Park, 13.VIII.45, ex *Eptesicus fuscus*, 1 ♀ (G.C.C.)
Trinity Valley, nr. Vernon, 24.VII.46, ex "brown bat", 5 ♀ (D.K.C.)

Specimens examined: 2 ♂, 9 ♀, including the allotype (♂).

HOST-FLEA INDEX

The following index of the fleas infesting mammals and birds pertains only to Canada, and is limited to actual records, new or published, up to December 31, 1946. While there are, in addition, a number of cases where flea-host associations may be predicted with certainty, these are not included. For example, the only fleas listed from *Aplodontia r. rufa* are *Dolichopsyllus stylosus* and *Epitedia scapani*, even though *Trichopsylloides oregonensis* and *Hystrichopsylla schefferi* are known to occur in Canada, and to be true parasites of that mammal. The only actual records we have of these latter fleas are from a mink, which presumably had preyed upon a "mountain beaver", or which had picked up the fleas while investigating the burrow of that animal. For further details on flea-host relationships, see p. 23.

Host nomenclature is corrected, interpreted, or otherwise brought up to date in this list. Names as supplied in original records are mentioned under the discussion of each species of flea.

Species considered to be true parasites of particular genera or species of host are marked with an asterisk (*); doubtful relationships are indicated by a query (?). Accidental records, obviously due to predation or habitat association, are not marked.

Nomenclature and sequence of the mammals follows Anderson (1946); of the birds, Taverner (1934) and the American Ornithologists' Union Check List, Fourth Edition (1935).

CLASS MAMMALIA

Order INSECTIVORA

Family Talpidae

Townsend's mole, *Scapanus townsendii* (Bachman)
- **Corypsylla ornata* C. Fox
- *Epitedia scapani* (Wagner)

Scheffer's mole, *Scapanus orarius schefferi* Jackson
- *Catallagia chamberlini* Hubbard
- **Corypsylla ornata* C. Fox
- *Epitedia scapani* (Wagner)
- ?*Nearctopsylla jordani* Hubbard

Hairly-tailed mole, *Parascalops breweri* (Bachman)
- ?*Ctenophthalmus pseudagyrtes* Baker
- ?*Doratopsylla blarinae* C. Fox
- ?*Hystrichopsylla tahavuana* Jordan

Gibbs' shrew mole, *Neürotrichus gibbsii gibbsii* (Baird)
- *Catallagia charlottensis* (Baker)
- **Corrodopsylla curvata obtusata* (Wagner)
- ?*Corypsylla ornata* C. Fox
- *Epitedia scapani* (Wagner)
- **Nearctopsylla jordani* Hubbard

Star-nosed mole, *Condylura cristata cristata* (Linnaeus)
- ?*Ctenophthalmus pseudagyrtes* Baker

Family Soricidae

Long-tailed shrews, *Sorex* spp.
- *Catallagia decipiens* Rothschild
- **Corrodopsylla curvata curvata* (Rothschild)
- **Corrodopsylla curvata obtusata* (Wagner)
- ?*Doratopsylla blarinae* C. Fox
- *Epitedia scapani* (Wagner)
- *Hystrichopsylla dippiei* Rothschild
- *Malaraeus telchinum* (Rothschild)
- *Monopsyllus wagneri ophidius* (Jordan)
- *Nosopsyllus fasciatus* (Bosc d'Antic)
- *Peromyscopsylla selenis* (Rothschild)
- **Nearctopsylla genalis hygini* (Rothschild

Cinereus shrew, *Sorex cinereus* ssp.
- ?*Ctenophthalmus pseudagyrtes* Baker
- **Nearctopsylla hyrtaci* (Rothschild)

Hayden's shrew, *Sorex cinereus haydeni* (Baird)
- **Corrodopsylla curvata curvata* (Rothschild)

Trowbridge shrew, *Sorex trowbridgii trowbridgii* Baird
Epitedia scapani (Wagner)

Vancouver Island shrew, *Sorax vagrans vancouverensis* Merriam
**Corrodopsylla curvata obtusata* (Wagner)

Dusky shrew, *Sorex obscurus* ssp.
**Nearctopsylla hyrtaci* (Rothschild)

Dusky shrew, *Sorex obscurus obscurus* Merriam
**Corrodopsylla curvata curvata* (Rothschild)

Short-tailed shrew, *Blarina brevicauda talpoides* (Gapper)
?*Corrodopsylla curvata curvata* (Rothschild)
?*Ctenophthalmus pseudagyrtes* Baker
**Doratopsylla blarinae* C. Fox
?*Hystrichopsylla tahavuana* Jordan
Monopsyllus vison (Baker)
Orchopeas leucopus (Baker)
Saphiopsylla bishopi (Jordan)

Order CHIROPTERA

Family Vespertilionidae

Little brown bat, *Myotis* sp.
**Myodopsylla gentilis* Jordan and Rothschild
**Myodopsylla insignis* (Rothschild)

Mouse-eared bat, *Myotis lucifugus* ssp.
**Myodopsylla gentilis* Jordan and Rothschild
**Myodopsylla insignis* (Rothschild)

Common mouse-eared bat, *Myotis lucifugus lucifugus* (LeConte)
**Myodopsylla insignis* (Rothschild)

Pacific mouse-eared bat, *Myotis lucifugus alascensis* Miller
**Myodopsylla gentilis* Jordan and Rothschild

Miller's mouse-eared bat, *Myotis yumanensis saturatus* Miller
**Myodopsylla gentilis* Jordan and Rothschild

Trouessart's mouse-eared bat, *Myotis keeni septentrionalis* (Trouessart)
**Myodopsylla insignis* (Rothschild)

Silver-haired bat, *Lasionycteris noctivagans* (LeConte)
**Eptescopsylla vancouverensis* (Wagner)

Big brown bat, *Eptesicus fuscus* ssp.
**Myodopsylloides palposus* (Rothschild)

Pacific big brown bat, *Eptesicus fuscus bernardinus* Rhoads
**Myodopsylloides palposus* (Rothschild)

Pale big brown bat, *Eptesicus fuscus pallidus* (Young)
**Myodopsylla insignis* (Rothschild)

Order PRIMATES

Family Hominidae

Man, *Homo sapiens* ssp.
(species of fleas recorded from man's person, or established in his home—
Ceratophyllus gallinae (Schrank)
Ceratophyllus garei Rothschild)
Ctenocephalides canis (Curtis)
Ctenocephalides felis felis (Bouché)
Dasypsyllus gallinulae perpinnatus (Baker)
Hystrichopsylla sp.
Monopsyllus ciliatus protinus (Jordan)
Monopsyllus eumolpi eumolpi (Rothschild)
Monopsyllus vison (Baker)
Monopsyllus wagneri wagneri (Baker)
Oropsylla arctomys (Baker)
?*Pulex irritans* Linnaeus
Xenopsylla cheopis (Rothschild)

Order CARNIVORA

Family Procyonidae

Pacific raccoon, *Procyon lotor pacifica* Merriam
Ctenocephalides felis felis (Bouché)

Family Ursidae

American black bear, *Euarctos americanus* ssp.
**Arctopsylla setosa* (Rothschild)

Grizzly bear, *Ursus* sp.
**Arctopsylla setosa* (Rothschild)
**Arctopsylla ursi* (Rothschild)
Thrassis spenceri Wagner

Family Canidae

Fox, *Vulpes* sp.
Hoplopsyllus glacialis glacialis (Taschenberg)

Red fox, *Vulpes fulva* group
Ctenocephalides canis (Curtis)
Malaraeus penicilliger dissimilis Jordan
Megabothris abantis (Rothschild)
Orchopeas caedens caedens (Jordan)
Oropsylla arctomys (Baker)

Kit fox, *Vulpes velox hebes* Merriam
Pulex irritans Linnaeus

Continental arctic fox, *Alopex lagopus innuitis* (Merriam)
Oropsylla alaskensis (Baker)

"*Canis* sp."
Oropsylla rupestris (Jordan)

Coyote, *Canis latrans* group
**Arctopsylla setosa* (Rothschild)
Megarthroglossus sicamus Jordan and Rothschild
Oropsylla arctomys (Baker)
Pulex irritans Linnaeus
Thrassis spenceri Wagner

Domestic dog, *Canis familiaris*
**Ctenocephalides canis* (Curtis)
**Ctenocephalides felis felis* (Bouché)

Family Mustelidae

Pine marten, *Martes americana* ssp.
?*Ceratophyllus tundrensis* Holland
Monopsyllus vison (Baker)
?*Nearctopsylla brooksi* (Rothschild)
?*Nearctopsylla hyrtaci* (Rothschild)
Orchopeas caedens caedens (Jordan)
Orchopeas caedens durus (Jordan)
Peromyscopsylla selenis (Rothschild)
Rectofrontia fraterna (Baker)
Tarsopsylla coloradensis (Baker)

Vancouver Island Marten, *Martes caurina vancouverensis* Grinnell and Dixon
Hystrichopsylla sp.
Monopsyllus ciliatus protinus (Jordan)
?*Nearctopsylla hyrtaci* (Rothschild)

Fisher, *Martes pennanti pennanti* (Erxleben)
Oropsylla arctomys (Baker)

Weasels, *Mustela* spp.
Foxella ignota albertensis (Jordan and Rothschild)
Megabothris atrox (Jordan)
Megarthroglossus divisus exsecatus Wagner
?*Nearctopsylla brooksi* (Rothschild)
Nearctopsylla genalis hygini (Rothschild)
Nearctopsylla genalis laurentina Jordan and Rothschild
?*Nearctopsylla hyrtaci* (Rothschild)
Neopsylla inopina Rothschild
Opisodasys keeni (Baker)
Orchopeas caedens caedens (Jordan)
Orchopeas caedens durus (Jordan)
Orchopeas 6-dentatus agilis (Rothschild)
Peromyscopsylla hamifer hamifer (Rothschild)

Short-tailed ermine, *Mustela erminea* ssp.
Epitedia wenmanni (Rothschild)
Foxella ignota recula (Jordan and Rothschild)
Hystrichopsylla sp.
Megabothris abantis (Rothschild)
Megabothris atrox (Jordan)
Megabothris quirini (Rothschild)
Nearctopsylla brooksi (Rothschild)
Nearctopsylla genalis hygini (Rothschild)
Nearctopsylla genalis laurentina Jordan and Rothsch.
Orchopeas caedens durus (Jordan)
Peromyscopsylla hamifer hamifer (Rothschild)

Vancouver Island ermine, *Mustela erminea anguinae* Hall
Hystrichopsylla sp.
Monopsyllus ciliatus protinus (Jordan)

Tundra weasel, *Mustela erminea arctica* (Merriam)
?*Ceratophyllus tundrensis* Holland
Oropsylla alaskensis (Baker)

Bonaparte weasel, *Mustela erminea cicognanii* Bonaparte
Megabothris abantis (Rothschild)
Monopsyllus wagneri wagneri (Baker)

Southwestern British Columbia coast ermine, *Mustela erminae fallenda* Hall
Megabothris abantis (Rothschild)
Monopsyllus ciliatus protinus (Jordan)
Orchopeas nepos (Rothschild)

Richardson's ermine, *Mustela erminae richardsonii* Bonaparte
?*Nearctopsylla brooksi* (Rothschild)

Long-tailed weasels, *Mustela frenata* ssp.
Catallagia decipiens Rothschild
Foxella ignota recula (Jordan and Rothschild)
Megabothris abantis (Rothschild)
Megabothris lucifer (Rothschild)
Monopsyllus eumolpi eumolpi (Rothschild)
Monopsyllus vison (Baker)
Monopsyllus wagneri wagneri (Baker)
?*Nearctopsylla brooksi* (Rothschild)
?*Nearctopsylla hyrtaci* (Rothschild)
Orchopeas caedens durus (Jordan)
Orchopeas 6-dentatus agilis (Rothschild)
Oropsylla idahoensis (Baker)

Prairie long-tailed weasel, *Mustela frenata longicauda* Bonaparte
- *Hystrichopsylla dippiei* Rothschild
- *Malaraeus euphorbi* (Rothschild)
- *Megabothris lucifer* (Rothschild)
- *Megabothris quirini* (Rothschild)
- ?*Nearctopsylla brooksi* (Rothschild)
- *Neopsylla inopina* Rothschild
- *Opisocrostis labis* (Jordan and Rothschild)
- *Oropsylla rupestris* (Jordan)
- *Rectofrontia fraterna* (Baker)
- *Thrassis bacchi* (Rothschild)

Nevada long-tailed weasel, *Mustela frenata nevadensis* Hall
- *Foxella ignota recula* (Jordan and Rothschild)
- *Orchopeas caedens durus* (Jordan)
- *Orchopeas 6-dentatus agilis* (Rothschild)

Bangs' long-tailed weasel, *Mustela frenata oribasa* (Bangs)
- *Megabothris abantis* (Rothschild)
- ?*Nearctopsylla brooksi* (Rothschild)
- *Oropsylla idahoensis* (Baker)

Mink, *Mustela vison* ssp.
- ?*Nearctopsylla brooksi* (Rothschild)
- ?*Nearctopsylla hyrtaci* (Rothschild)
- *Orchopeas caedens caedens* (Jordan)

Eastern mink, *Mustela vison vison* Schreber
- *Monopsyllus vison* (Baker)

British Columbia mink, *Mustela vison energumenos* (Bangs)
- *Hystrichopsylla* sp.
- *Hystrichopsylla schefferi* Chapin
- ?*Nearctopsylla hyrtaci* (Rothschild)
- *Orchopeas nepos* (Rothschild)
- *Trichopsylloides oregonensis* Ewing

Wolverine, *Gulo luscus* ssp.
- **Arctopsylla setosa* (Rothschild)
- *Thrassis spenceri* Wagner

Puget Sound spotted skunk, *Spilogale gracilis olympica* (Elliot)
- *Atyphloceras multidentatus* (C. Fox)
- *Ctenocephalides canis* (Curtis)
- ?*Hystrichopsylla spinata* n. sp.
- *Hystrichopsylla schefferi* Chapin
- *Megarthroglossus procus* Jordan and Rothschild
- *Micropsylla sectilis goodi* Hubbard
- *Monopsyllus ciliatus protinus* (Jordan)
- *Monopsyllus wagneri ophidius* (Jordan)
- *Orchopeas nepos* (Rothschild)
- *Orchopeas 6-dentatus agilis* (Rothschild)

Northeastern striped skunk, *Mephitis mephitis mephitis* (Schreber)
- *Megabothris quirini* (Rothschild)
- *Monopsyllus vison* (Baker)
- *Orchopeas caedens durus* (Jordan)
- *Oropsylla arctomys* (Baker)

Puget Sound striped skunk, *Mephitis mephitis spissigrada* Bangs
- *Thrassis acamantis* (Rothschild)

American badger, *Taxidea taxus taxus* (Schreber)
- *Opisocrostis bruneri* (Baker)
- *Opisocrostis labis* (Jordan and Rothschild)
- *Oropsylla arctomys* (Baker)
- *Oropsylla rupestris* (Jordan)
- *Pulex irritans* Linnaeus

Family Felidae

Domestic cat, *Felis domestica*
- **Ctenocephalides canis* (Curtis)
- **Ctenocephalides felis felis* (Bouché)
- *Monopsyllus vison* (Baker)
- *Opisocrostis bruneri* (Baker)

Lynx or bob-cat, *Lynx* sp.
- *Hoplopsyllus glacialis lynx* (Baker)
- *Megarthroglossus sicamus* Jordan and Rothschild
- *Monopsyllus thambus* (Jordan)
- *Orchopeas 6-dentatus agilis* (Rothschild)
- *Pulex irritans* Linnaeus

Canada lynx, *Lynx canadensis canadensis* Kerr
- **Arctopsylla setosa* (Rothschild)
- *Foxella ignota albertensis* (Jordan and Rothschild)
- *Hoplopsyllus glacialis glacialis* (Taschenberg)
- *Hoplopsyllus glacialis lynx* (Baker)
- *Opisodasys vesperalis* (Jordan)
- *Orchopeas caedens durus* (Jordan)

Barred bob-cat, *Lynx rufus fasciatus* Rafinesque
- *Hoplopsyllus glacialus lynx* (Baker)

Order RODENTIA

Suborder DUPLICIDENTATA

Family Ochotonidae

Pikas, *Ochotona princeps* ssp.
- *Catallagia decipiens* Rothschild
- **Ctenophyllus terribilis* (Rothschild)
- *Megabothris abantis* (Rothschild)
- ?*Megarthroglossus spenceri* Wagner
- *Monopsyllus vison* (Baker)
- *Orchopeas caedens durus* (Jordan)
- *Orchopeas 6-dentatus agilis* (Rothschild)
- *Peromyscopsylla ravalliensis* (Dunn)
- *Rectofrontia fraterna* (Baker)

Rocky Mountain pika, *Ochotona princeps princeps* (Richardson)
**Amphalius necopinus* (Jordan)
**Ctenophyllus terribilis* (Rothschild)
Orchopeas 6-dentatus agilis (Rothschild)
Oropsylla idahoensis (Baker)

Shuswap pika, *Ochotona princeps brooksi* Howell
**Ctenophyllus terribilis* (Rothschild)
Orchopeas 6-dentatus agilis (Rothschild)
Rectofrontia fraterna (Baker)

Cascade pika, *Ochotona princeps brunnescens* (Howell)
Orchopeas 6-dentatus agilis (Rothschild)

Bangs' pika, *Ochotona princeps cuppes* (Bangs)
**Amphalius necopinus* (Jordan)
**Ctenophyllus terribilis* (Rothschild)

Ashnola pika, *Ochotona princeps fenisex* (Osgood)
Catallagia decipiens Rothschild
**Ctenophyllus terribilis* (Rothschild)
Monopsyllus eumolpi eumolpi (Rothschild)
Orchopeas 6-dentatus agilis (Rothschild)

Family Leporidae

Arctic hares, *Lepus arcticus* group
**Hoplopsyllus glacialis glacialis* (Taschenberg)

White-tailed jack rabbit, *Lepus townsendii campanius* Hollister
Oropsylla rupestris (Jordan)
Pulex irritans Linnaeus

European hare, *Lepus europaeus europaeus* Pallas
Cediopsylla simplex (Baker)

Varying hares, *Lepus americanus* group
**Hoplopsyllus glacialis lynx* (Baker)
Megabothris abantis (Bothschild)
Monopsyllus ciliatus protinus (Jordan)

"Bush rabbits" (*Lepus americanus* ssp. ?)
?Hoplopsyllus glacialis glacialis (Taschenberg)
**Hoplopsyllus glacialis lynx* (Baker)
Opisocrostis bruneri (Baker)

British Columbia varying hare, *Lepus americanus columbiensis* Rhoads
**Hoplopsyllus glacialis lynx* (Baker)

Mackenzie varying hare, *Lepus americanus macfarlani* Merriam
?Hoplopsyllus glacialis glacialis (Taschenberg)
**Hoplopsyllus glacialis lynx* (Baker)

Hares, *Lepus* spp.
**Cediopsylla inaequalis inaequalis* (Baker)
**Hoplopsyllus affinis* (Baker)
Hystrichopsylla dippiei Rothschild
Opisocrostis tuberculatus tuberculatus (Baker)

"Tame rabbit", *Oryctolagus cuniculus* (Linnaeus)
Ctenocephalides canis (Curtis)

Cottontail rabbits, *Sylvilagus* spp.
**Cediopsylla inaequalis inaequalis* (Baker)
**Odontopsyllus dentatus* (Baker)
Oropsylla arctomys (Baker)
Tamiophila grandis (Rothschild)

Mearns' cottontail, *Sylvilagus floridanus mearnsi* (Allen)
**Cediopsylla simplex* (Baker)
Tamiophila grandis (Rothschild)

Washington cottontail, *Sylvilagus nuttalli nuttalli* (Bachman)
Orchopeas 6-dentatus agilis (Rothschild)

Black Hills cottontail, *Sylvilagus nuttalli grangeri* (Allen)
**Cediopsylla inaequalis inaequalis* (Baker)
Megabothris quirini (Rothschild)
**Odontopsyllus dentatus* (Baker)

Suborder SIMPLICIDENTATA

Family Sciuridae

Marmots, *Marmota* spp.
**Oropsylla arctomys* (Baker)
**Thrassis acamantis* (Rothschild)

Woodchucks, *Marmota monax* ssp.
Opisocrostis bruneri (Baker)
**Oropsylla arctomys* (Baker)
?Thrassis spenceri Wagner

British Columbia woodchuck, *Marmota monax petrensis* Howell
**Oropsylla arctomys* (Baker)
?Thrassis spenceri Wagner

Rufescent woodchuck, *Marmota monax rufescens* Howell
**Oropsylla arctomys* (Baker)

Pallid yellow-bellied marmot, *Marmota flaviventris avara* (Bangs)
**Thrassis acamantis* (Rothschild)

Hoary marmots, *Marmota caligata* ssp.
?Oropsylla arctomys (Baker)
**Thrassis spenceri* Wagner

Cascade hoary marmot, *Marmota caligata cascadensis* Howell
**Thrassis spenceri* Wagner

Okanagan hoary marmot, *Marmota caligata okanagana* (King)
?*Oropsylla arctomys* (Baker)
**Thrassis spenceri* Wagner

Vancouver Island marmot, *Marmota vancouverensis* Swarth
**Thrassis spenceri* Wagner

Richardson's ground squirrel, *Citellus richardsonii richardsonii* (Sabine)
Catallagia decipiens Rothschild
Ctenophthalmus pseudagyrtes Baker
Epitedia wenmanni (Rothschild)
?*Hystrichopsylla dippiei* Rothschild
Megabothris asio megacolpus (Jordan)
Megabothris lucifer (Rothschild)
Monopsyllus wagneri systaltus (Jordan)
**Neopsylla inopina* Rothschild
? *Opisocrostis bruneri* (Baker)
**Opisocrostis labis* (Jordan and Rothschild)
**Opisocrostis saundersi* (Jordan)
**Opisocrostis tuberculatus tuberculatus* (Baker)
Oropsylla idahoensis (Baker)
**Oropsylla rupestris* (Jordan)
Peromyscopsylla selenis (Rothschild)
**Rectofrontia fraterna* (Baker)
?*Thrassis bacchi* (Rothschild)

Columbian ground squirrel, *Citellus columbianus columbianus* (Ord)
Callistopsyllus terinus (Rothschild)
Catallagia charlottensis (Baker)
Catallagia decipiens Rothschild
Foxella ignota recula (Jordan and Rothschild)
?*Hystrichopsylla dippiei* Rothschild
Megabothris abantis (Rothschild)
Micropsylla sectilis sectilis (Jordan and Rothschild)
Monopsyllus eumolpi eumolpi (Rothschild)
**Neopsylla inopina* Rothschild
**Opisocrostis tuberculatus tuberculatus* (Baker)
**Oropsylla idahoensis* (Baker)
**Rectofrontia fraterna* (Baker)
Thrassis acamantis (Rothschild)
**Thrassis petiolatus* (Baker)

Hudson Bay ground squirrel, *Citellus parryi parryi* (Richardson)
**Oropsylla alaskensis* (Baker)

Thirteen-striped ground squirrel, *Citellus tridecemlineatus* ssp.
?*Opisocrostis bruneri* (Baker)
?*Opisocrostis tuberculatus tuberculatus* (Baker)
Oropsylla idahoensis (Baker)
**Thrassis bacchi* (Rothschild)

Franklin ground squirrel, *Citellus franklinii* (Sabine)
Megabothris quirini (Rothschild)
?*Neopsylla inopina* Rothschild
**Opisocrostis bruneri* (Baker)
**Opisocrostis labis* (Jordan and Rothschild)
Orchopeas caedens caedens (Jordan)
Oropsylla rupestris (Jordan)

Say ground squirrel, *Citellus lateralis* ssp.
**Oropsylla idahoensis* (Baker)

Hollister mantled ground squirrel, *Citellus lateralis tescorum* (Hollister)
**Oropsylla idahoensis* (Baker)

Washington mantled ground squirrel, *Citellus saturatus* (Rhoads)
**Oropsylla idahoensis* (Baker)

Black-tailed prairie-dog, *Cynomys ludovicianus ludovicianus* (Ord)
Opisocrostis labis (Jordan and Rothschild)
?*Opisocrostis tuberculatus tuberculatus* (Baker)
Oropsylla rupestris (Jordan)
Thrassis bacchi (Rothschild)

Eastern chipmunk, *Tamias striatus* ssp.
**Megabothris acerbus* (Jordan)
Orchopeas leucopus (Baker)
**Tamiophila grandis* (Rothschild)

Gray eastern chipmunk, *Tamias striatus griseus* Mearns
**Megabothris acerbus* (Jordan)

Lyster chipmunk, *Tamias striatus lysteri* (Richardson)
Epitedia wenmanni (Rothschild)
Orchopeas howardii (Baker)
**Tamiophila grandis* (Rothschild)

Western chipmunks, *Eutamias* spp.
Catallagia chamberlini Hubbard
Ctenophthalmus pseudagyrtes Baker
Epitedia wenmanni (Rothschild)
Megabothris abantis (Rothschild)
?*Monopsyllus ciliatus protinus* (Jordan)
**Monopsyllus eumolpi eumolpi* (Rothschild)
Orchopeas caedens durus (Jordan)
Peromyscopsylla selenis (Rothschild)
Thrassis acamantis (Rothschild)
Thrassis petiolatus (Baker)

Chipmunks, *Eutamias minimus* ssp.
Ctenophthalmus pseudagyrtes Baker
**Monopsyllus eumolpi eumolpi* (Rothschild)

Northern chipmunk, *Eutamias minimus borealis* (Allen)
Megabothris quirini (Rothschild)
**Monopsyllus eumolpi eumolpi* (Rothschild)
Opisocrostis bruneri (Baker)

Grey-headed chipmunk, *Eutamias minimus caniceps* (Osgood)
Orchopeas caedens durus (Jordan)

Selkirk chipmunk, *Eutamias minimus selkirki* Cowan
**Monopsyllus eumolpi eumolpi* (Rothschild)

Chipmunks, *Eutamias amoenus* ssp.
Catallagia decipiens Rothschild
**Monopsyllus eumolpi eumolpi* (Rothschild)
Orchopeas caedens durus (Jordan)

Columbian chipmunk, _Eutamias amoenus affinis_ (Allen)
Catallagia decipiens Rothschild
Hystrichopsylla dippiei Rothschild
*_Monopsyllus eumolpi eumolpi_ (Rothschild)

Tawny chipmunk, _Eutamias amoenus felix_ (Rhoads)
?_Monopsyllus ciliatus protinus_ (Jordan)
*_Monopsyllus eumolpi eumolpi_ (Rothschild)

Hollister chipmunk, _Eutamias amoenus ludibundus_ (Hollister)
*_Monopsyllus eumolpi eumolpi_ (Rothschild)

Buff-bellied chipmunk, _Eutamias amoenus luteiventris_ (Allen)
*_Monopsyllus eumolpi eumolpi_ (Rothschild)

Townsend chipmunk, _Eutamias townsendii_ ssp.
?_Monopsyllus ciliatus protinus_ (Jordan)

Cooper chipmunk, _Eutamias townsendii cooperi_ (Baird)
?_Monopsyllus ciliatus protinus_ (Jordan)

Red squirrels, _Tamiasciurus_ spp.
*_Monopsyllus ciliatus protinus_ (Jordan)
*_Orchopeas caedens durus_ (Jordan)

Red squirrels, _Tamiasciurus hudsonicus_ ssp.
Catallagia decipiens Rothschild
Ceratophyllus niger C. Fox
Ctenophthalmus pseudagyrtes Baker
Epitedia wenmanni (Rothschild)
?_Hystrichopsylla dippiei_ Rothschild
*_Megarthroglossus divisus exsecatus_ Wagner
Monopsyllus eumolpi eumolpi (Rothschild)
*_Monopsyllus vison_ (Baker)
Opisodasys pseudarctomys (Baker)
*_Orchopeas caedens caedens_ (Jordan)
*_Orchopeas caedens durus_ (Jordan)
?_Rectofrontia fraterna_ (Baker)
*_Tarsopsylla coloradensis_ (Baker)

Northern red squirrel, _Tamiasciurus hudsonicus hudsonicus_ (Erxleben)
Megabothris quirini (Rothschild)
*_Monopsyllus vison_ (Baker)
Opisodasys pseudarctomys (Baker)
*_Orchopeas caedens durus_ (Jordan)
Peromyscopsylla catatina (Jordan)
*_Tarsopsylla coloradensis_ (Baker)

British Columbia red squirrel, _Tamiasciurus hudsonicus columbiensis_ (Howell)
Megabothris quirini (Rothschild)
*_Megarthroglossus divisus exsecatus_ Wagner
*_Monopsyllus vison_ (Baker)
*_Orchopeas caedens durus_ (Jordan)
*_Tarsopsylla coloradensis_ (Baker)

Bangs' red squirrel, _Tamiasciurus hudsonicus gymnicus_ (Bangs)
Ctenophthalmus pseudagyrtes Baker
Orchopeas howardii (Baker)

Southern red squirrel, _Tamiasciurus hudsonicus loquax_ (Bangs)
Orchopeas howardii (Baker)

Preble red squirrel, _Tamiasciurus hudsonicus preblei_ (Howell)
*_Orchopeas caedens caedens_ (Jordan)
Orchopeas 6-dentatus agilis (Rothschild)

Richardson's red squirrel, _Tamiasciurus hudsonicus richardsoni_ (Bachman)
*_Megarthroglossus divisus divisus_ (Baker)
*_Monopsyllus vison_ (Baker)

Streator's red squirrel, _Tamiasciurus hudsonicus streatori_ (Allen)
Atyphloceras artius Jordan (?)
Catallagia decipiens Rothschild
Epitedia wenmanni (Rothschild)
?_Hystrichopsylla dippiei_ Rothschild
Megabothris abantis (Rothschild)
*_Megarthroglossus divisus exsecatus_ Wagner
*_Monopsyllus vison_ (Baker)
Opisodasys pseudarctomys (Baker)
*_Orchopeas caedens durus_ (Jordan)
*_Tarsopsylla coloradensis_ (Baker)
Thrassis acamantis (Rothschild)

Vancouver Island red squirrel, _Tamiasciurus hudsonicus vancouverensis_ (Allen)
*_Monopsyllus ciliatus protinus_ (Jordan)

Northwestern red-bellied squirrel, _Tamiasciurus douglassi mollipilosus_ (Audubon and Bachman)
Dasypsyllus gallinulae perpinnatus (Baker)
?_Hystrichopsylla_ sp.
*_Megarthroglossus procus_ Jordan and Rothschild
Micropsylla sectilis goodi Hubbard
*_Monopsyllus ciliatus protinus_ (Jordan)
Nosopsyllus fasciatus (Bosc d'Antic)
Orchopeas caedens durus (Jordan) (?)
*_Orchopeas nepos_ (Rothschild)

Northern grey squirrel, _Sciurus carolinensis leucotis_ (Gapper)
?_Monopsyllus vison_ (Baker)
*_Orchopeas howardii_ (Baker)

Flying squirrels, _Glaucomys_ spp.
*_Opisodasys pseudarctomys_ (Baker)

Small eastern flying squirrel, _Glaucomys volans volans_ (Linnaeus)
?_Conorhinopsylla stanfordi_ Stewart
Orchopeas howardii (Baker)

Flying squirrels, _Glaucomys sabrinus_ ssp.
Monopsyllus ciliatus protinus (Jordan)
*_Opisodasys pseudarctomys_ (Baker)
*_Opisodasys vesperalis_ (Jordan)
Orchopeas caedens durus (Jordan)

Richardson's flying squirrel, _Glaycomys sabrinus alpinus_ (Richardson)
*_Opisodasys pseudarctomys_ (Baker)
*_Opisodasys vesperalis_ (Jordan)
Orchopeas caedens durus (Jordan)
?_Tarsopsylla coloradensis_ (Baker)

Okanagan flying squirrel, *Glaucomys sabrinus columbiensis* Howell
Monopsyllus vison (Baker)
**Opisodasys pseudarctomys* (Baker)
**Opisodasys vesperalis* (Jordan)
Orchopeas caedens durus (Jordan)

Dusky flying squirrel, *Glaucomys sabrinus fuliginosus* (Rhoads)
Megarthroglossus divisus exsecatus Wagner
**Opisodasys vesperalis* (Jordan)
?*Tarsopsylla coloradensis* (Baker)

Mearns' flying squirrel, *Glaucomys sabrinus macrotis* (Mearns)
**Opisodasys pseudarctomys* (Baker)
Orchopeas leucopus (Baker)

Bachman's flying squirrel, *Glaucomys sabrinus oregonensis* (Bachman)
Orchopeas nepos (Rothschild)

Family Geomyidae

Pocket gophers, *Thomomys talpoides* ssp.
Catallagia decipiens Rothschild
**Dactylopsylla comis* Jordan
**Foxella ignota albertensis* (Jordan and Rothschild)
**Foxella ignota recula* (Jordan and Rothschild)
Hystrichopsylla dippiei Rothschild
Oropsylla rupestris (Jordan)
Thrassis petiolatus (Baker)

Anderson's pocket gopher, *Thomomys talpoides andersoni* Goldman
**Foxella ignota albertensis* (Jordan and Rothschild)
Oropsylla idahoensis (Baker)

Shuswap pocket gopher, *Thomomys talpoides incensus* Goldman
**Foxella ignota recula* (Jordan and Rothschild)

Dakota pocket gopher, *Thomomys talpoides rufescens* (Wied)
**Foxella ignota albertensis* (Jordan and Rothschild)
Monopsyllus wagneri systaltus (Jordan)

Family Heteromyidae

Anarchist Mountain pocket mouse, *Perognathus parvus laingi* Anderson
**Meringis shannoni* (Jordan)

Lord's pocket mouse, *Perognathus parvus lordi* (Gray)
**Meringis shannoni* (Jordan)

Family Cricetidae

Audubon grasshopper mouse, *Onychomys leucogaster missouriensis* (Audubon and Bachman)
?*Catallagia decipiens* Rothschild
Monopsyllus wagneri systaltus (Jordan)
?*Rectofrontia fraterna* (Baker)

Dusky harvest mouse, *Reithrodontomys megalotis nigrescens* Howell
?*Monopsyllus wagneri wagneri* (Baker)

White-footed mice, *Peromyscus* spp.
**Catallagia decipiens* Rothschild
**Ctenophthalmus pseudagyrtes* Baker
Doratopsylla blarinae C. Fox
**Malaraeus telchinum* (Rothschild)
**Monopsyllus thambus* (Jordan)
**Opisodasys keeni* (Baker)
**Orchopeas leucopus* (Baker)

White-footed mice, *Peromyscus maniculatus* ssp.
?*Atyphloceras multidentatus* (C. Fox)
**Callistopsyllus terinus* (Rothschild)
**Catallagia chamberlini* Hubbard
**Catallagia charlottensis* (Baker)
**Catallagia decipiens* Rothschild
?*Delotelis telegoni* (Rothschild)
**Epitedia scapani* (Wagner)
**Epitedia wenmanni* (Rothschild)
?*Hystrichopsylla occidentalis* n. sp.
**Malaraeus euphorbi* (Rothschild)
**Malaraeus telchinum* (Rothschild)
Megabothris abantis (Rothschild)
Megarthroglossus divisus exsecatus Wagner
**Micropsylla sectilis goodi* Hubbard
**Micropsylla sectilis sectilis* (Jordan and Rothschild)
Monopsyllus ciliatus protinus (Jordan)
**Monopsyllus thambus* (Jordan)
**Monopsyllus wagneri ophidius* (Jordan)
**Monopsyllus wagneri wagneri* (Baker)
Nosopsyllus fasciatus (Bosc d'Antic)
**Opisodasys keeni* (Baker)
**Orchopeas leucopus* (Baker)
Peromyscopsylla ravalliensis (Dunn)
Peromyscopsylla selenis (Rothschild)

Silkirk white-footed mouse, *Peromyscus maniculatus alpinus* Cowan
**Opisodasys keeni* (Baker)

Sagebrush white-footed mouse, *Peromyscus maniculatus artemisiae* (Rhoads)
?*Atyphloceras artius* Jordan
**Callistopsyllus terinus* (Rothschild)
**Catallagia decipiens* Rothschild
**Epitedia wenmanni* (Rothschild)
?*Hystrichopsylla dippiei* Rothschild
**Malaraeus euphorbi* (Rothschild)
**Malaraeus telchinum* (Rothschild)
Megabothris abantis (Rothschild)
Megabothris quirini (Rothschild)
Meringis shannoni (Jordan)
**Micropsylla sectilis sectilis* (Jordan and Rothschild)
**Monopsyllus wagneri wagneri* (Baker)

Puget Sound white-footed mouse, *Peromyscus maniculatus austerus* (Baird)
Atyphloceras miltidentatus (C. Fox)
**Catallagia charlottensis* (Baker)
?*Delotelis telegoni* (Rothschild)
**Epitedia scapani* (Wagner)
**Micropsylla sectilis goodi* Hubbard
Monopsyllus ciliatus protinus (Jordan)
**Monopsyllus wagneri ophidius* (Jordan
**Opisodasys keeni* (Baker)

?Hystrichopsylla occidentalis n.sp.
*Malaraeus telchinum (Rothschild)
Megabothris abantis (Rothschild)
*Peromyscopsylla hesperomys pacifica n.ssp.
Peromyscopsylla selenis (Rothschild)

Michigan white-footed mouse, Peromyscus maniculatus bairdi (Hoy and Kennicott)
*Orchopeas leucopus (Baker)

Mackenzie white-footed mouse, Peromyscus maniculatus borealis (Mearns)
*Catallagia charlottensis (Baker)
*Catallagia decipiens Rothschild
*Ctenophthalmus pseudagyrtes Baker
*Epitedia wenmanni (Rothchild)
*Malaraeus euphorbi (Rothschild)
Malaraeus penicilliger dissimilis Jordan
*Malaraeus telchinum (Rothschild)
Megabothris abantis (Rothschild)
Megabothris quirini (Rothschild)
*Monopsyllus thambus (Jordan)
*Monopsyllus wagneri wagneri (Baker)
*Opisodasys keeni (Baker)
*Orchopeas leucopus (Baker)
Peromyscopsylla selenis (Rothschild)

LeConte white-footed mouse, Peromyscus maniculatus gracilis (LeConte)
*Epitedia wenmanni (Rothschild)
Monopsyllus vison (Baker)
*Orchopeas leucopus (Baker)
?Saphiopsylla bishopi (Jordan)
?Stenoponia americana (Baker)

Big Vancouver Island white-footed mouse, Peromyscus maniculatus interdictus Anderson
*Catallagia charlottensis (Baker)
*Malaraeus telchinum (Rothschild)
*Monopsyllus wagneri ophidius (Jordan)
*Opisodasys keeni (Baker)
*Peromyscopsylla hesperomys pacifica n.ssp.

Queen Charlotte white-footed mouse, Peromyscus maniculatus keeni (Rhoads)
*Catallagia charlottensis (Baker)
*Opisodasys keeni (Baker)

keena white-footed mouse, Peromyscus maniculatus macrorhinus (Rhoads)
*Catallagia charlottensis (Baker)

Cascades white-footed mouse, Peromyscus maniculatus oreas (Bangs)
*Catallagia charlottensis (Baker)
*Epitedia scapani (Wagner)
?Hystrichopsylla occidentalis n.sp.
*Malaraeus telchinum (Rothschild)
Megabothris abantis (Rothschild)
*Micropsylla sectilis goodi Hubbard
Monopsyllus ciliatus protinus (Jordan)
*Monopsyllus wagneri ophidius (Jordan)
*Opisodasys keeni (Baker)
*Peromyscopsylla hesperomys pacifica n.ssp.

Osgood's white-footed mouse, Peromyscus maniculatus osgoodi Mearns
*Callistopsyllus campestris n.sp.
*Catallagia decipiens Rothschild
*Epitedia wenmanni (Rothschild)
?Hystrichopsylla dippiei Rothschild
*Malaraeus euphorbi (Rothschild)
Megabothris asio megacolpus (Jordan)
Megabothris lucifer (Rothschild)
*Monopsyllus wagneri systaltus (Jordan)
Neopsylla inopina Rothschild
*Orchopeas leucopus (Baker)
Rectofrontia fraterna (Baker)

Northern deer mouse, Peromyscus leucopus noveboracensis (Fischer)
*Ctenophthalmus pseudagyrtes Baker
*Orchopeas leucopus (Baker)

Bushy-tailed woodrat, Neotoma cinerea ssp.
Catallagia decipiens Rothschild
Epitedia wenmanni (Rothschild)
Megabothris abantis (Rothschild)
?Megarthroglossus pygmaeus Wagner
Orchopeas caedens durus (Jordan)
*Orchopeas 6-dentatus agilis (Rothschild)
*Peromyscopsylla ravalliensis (Dunn)

Drummond's bushy-tailed woodrat, Neotoma cinerea drummondi (Richardson)
?Megarthroglossus divisus divisus (Baker)
?Rectofrontia fraterna (Baker)

Western bushy-tailed woodrat, Neotoma cinerea occidentalis (Baird)
Megabothris abantis (Rothschild)
*Megarthroglossus sicamus Jordan and Rothschild
?Megarthroglossus similis Wagner
*Orchopeas 6-dentatus agilis (Rothschild)
*Peromyscopsylla ravalliensis (Dunn)

Lemming mouse, Synaptomys spp.
Catallagia charlottensis (Baker)
?Megabothris abantis (Rothschild)

Richardson's lemming mouse, Synaptomys borealis borealis (Richardson)
?Peromyscopsylla selenis (Rothschild)

Wrangell lemming mouse, Synaptomys borealis wrangeli Merriam
?Megabothris abantis (Rothschild)

"Lemming" (Lemmus? Dicrostonyx?)
*Megabothris immitis (Jordan)

Back lemming, Lemmus trimucronatus ssp.
*Megabothris groenlandicus (Wahlgren)

Rocky Mountain phenacomys, Phenacomys intermedius ssp.
Catallagia decipiens Rothschild
?Hystrichopsylla dippiei Rothschild
?Malaraeus penicilliger dissimilis Jordan
*Megabothris abantis (Rothschild)
Monopsyllus vison (Baker)
Monopsyllus wagneri wagneri (Baker)
*Peromyscopsylla selenis (Rothschild)
?Rectofrontia fraterna (Baker)

Red-backed mice, *Clethrionomys gapperi* ssp.
- **Catallagia chamberlini* Hubbard
- *Catallagia charlottensis* (Baker)
- *Catallagia decipiens* Rothschild
- *Ceratophyllus gallinae* (Schrank)
- *Ctenophthalmus pseudagyrtes* Baker
- **Delotelis telegoni* (Rothschild)
- *Epitedia wenmanni* (Rothschild)
- **Hystrichopsylla occidentalis* n.sp.
- **Malaraeus penicilliger dissimilis* Jordan
- **Megabothris abantis* (Rothschild)
- *Monopsyllus eumolpi eumolpi* (Rothschild)
- *Monopsyllus wagneri systaltus* (Jordan)
- *Opisodasys keeni* (Baker)
- *Opisodasys pseudarctomys* (Baker)
- **Peromyscopsylla selenis* (Rothschild)
- ?*Peromyscopsylla catatina* (Jordan)

Gapper red-backed mouse, *Clethrionomys gapperi gapperi* (Vigors)
- **Megabothris quirini* (Rothschild)
- *Monopsyllus vison* (Baker)
- *Orchopeas leucopus* (Baker)
- ?*Peromyscopsylla catatina* (Jordan)

Athabasca red-backed mouse, *Clethrionomys gapperi athabascae* (Preble)
- **Amphipsylla sibirica pollionis* (Rothschild)
- **Malaraeus penicilliger dissimilis* Jordan
- **Megabothris quirini* (Rothschild)
- **Peromyscopsylla selenis* (Rothschild)

Kootenay red-backed mouse, *Clethrionomys gapperi saturatus* (Rhoads)
- ?*Catallagia decipiens* Rothschild
- **Delotelis telegoni* (Rothschild)
- ?*Hystrichopsylla dippiei* Rothschild
- **Malaraeus penicilliger dissimilis* Jordan
- *Malaraeus telchinum* (Rothschild)
- **Megabothris abantis* (Rothschild)
- **Megabothris quirini* (Rothschild)
- *Monopsyllus wagneri wagneri* (Baker)
- *Nearctopsylla hyrtaci* (Rothschild)
- *Orchopeas 6-dentatus agilis* (Rothschild)
- **Peromyscopsylla selenis* (Rothschild)

Plains red-backed mouse, *Clethrionomys gapperi loringi* (Bailey)
- **Amphipsylla sibirica pollionis* (Rothschild)
- ?*Catallagia decipiens* Rothschild
- ?*Ctenophthalmus pseudagyrtes* Baker
- **Megabothris quirini* (Rothschild)
- *Neopsylla inopina* Rothschild
- *Orchopeas leucopus* (Baker)
- **Peromyscopsylla selenis* (Rothschild)

Meadow mice, *Microtus* spp.
- *Catallagia charlottensis* (Baker)
- **Megabothris abantis* (Rothschild)
- **Megabothris asio megacolpus* (Jordan)
- **Megabothris quirini* (Rothschild)
- *Opisodasys keeni* (Baker)
- *Orchopeas leucopus* (Baker)
- **Peromyscopsylla selenis* (Rothschild)
- ?*Saphiopsylla bishopi* (Jordan)

Eastern meadow mouse, *Microtus pennsylvanicus pennsylvanicus* (Ord)
- ?*Ctenophthalmus pseudagyrtes* Baker
- **Epitedia wenmanni* (Rothschild)
- **Megabothris asio asio* (Baker)
- **Megabothris quirini* (Rothschild)
- *Nosopsyllus fasciatus* (Bosc d'Antic)
- *Orchopeas leucopus* (Baker)
- ?*Peromyscopsylla catatina* (Jordan)
- **Peromyscopsylla hamifer hamifer* (Rothschild)
- ?*Saphiopsylla bishopi* (Jordan)

Drummond's meadow mouse, *Microtus pennsylvanicus drummondii* (Audubon and Bachman)
- **Amphipsylla sibirica pollionis* (Rothschild)
- ?*Catallagia decipiens* Rothschild
- ?*Ctenophthalmus pseudagyrtes* Baker
- **Delotelis telegoni* (Rothschild)
- **Epitedia wenmanni* (Rothschild)
- **Megabothris abantis* (Rothschild)
- **Megabothris asio megacolpus* (Jordan)
- **Megabothris lucifer* (Rothschild)
- **Megabothris quirini* (Rothschild)
- *Monopsyllus eumolpi eumolpi* (Rothschild)
- *Monopsyllus wagneri systaltus* (Jordan)
- **Peromyscopsylla selenis* (Rothschild)

Badlands meadow mouse, *Microtus pennsylvanicus insperatus* (Allen)
- **Megabothris quirini* (Rothschild)

Grey meadow mouse, *Microtus montanus canescens* Bailey
- ?*Catallagia decipiens* Rothschild
- **Megabothris lucifer* (Rothschild)

Townsend's meadow mouse, *Microtus townsendii townsendii* (Bachman)
- *Catallagia charlottensis* (Baker)
- *Corypsylla ornata* C. Fox
- **Delotelis telegoni* (Rothschild)
- ?*Hystrichopsylla occidentalis* n.sp.
- *Opisodasys keeni* (Baker)

Olympic meadow mouse, *Microtus longicaudus macrurus* (Merriam)
- *Catallagia charlottensis* (Baker)
- ?*Hystrichopsylla occidentalis* n.sp.
- **Megabothris abantis* (Rothschild)

Cantankerous meadow mouse, *Microtus longicaudus mordax* (Merriam)
- ?*Catallagia decipiens* Rothschild
- **Delotelis telegoni* (Rothschild)
- ?*Hystrichopsylla dippiei* Rothschild
- ?*Hystrichopsylla occidentalis* n.sp.
- *Malaraeus telchinum* (Rothschild)
- **Megabothris abantis* (Rothschild)
- *Megarthroglossus divisus divisus* (Baker)
- *Monopsyllus wagneri wagneri* (Baker)
- *Orchopeas 6-dentatus agilis* (Rothschild)
- *Oropsylla idahoensis* (Baker)
- **Peromyscopsylla selenis* (Rothschild)

Rock vole, *Microtus chrotorrhinus chrotorrhinus* Miller
- *Orchopeas leucopus* (Baker)
- ?*Peromyscopsylla catatina* (Jordan)

Richardson's water vole, *Microtus richardsoni richardsoni* (DeKay)
?Catallagia chamberlini Hubbard
**Megabothris abantis* (Rothschild)

Creeping meadow mouse, *Microtus oregoni serpens* Merriam
**Atyphloceras multidentatus* (C. Fox)
Catallagia charlottensis (Baker)
Corrodopsylla curvata obtusata (Wagner)
Corypsylla ornata C. Fox
**Delotelis telegoni* (Rothschild)
Epitedia scapani (Wagner)
?Hystrichopsylla occidentalis n.sp.
**Megabothris abantis* (Rothschild)
**Megabothris quirini* (Rothschild)
Micropsylla sectilis goodi Hubbard
Opisodasys keeni (Baker)
**Peromyscopsylla selenis* (Rothschild)

Northern pine mouse, *Pitymys pinetorum scalapsoides* (Audubon and Bachman)
?Ctenophthalmus pseudagyrtes Baker
?Hystrichopsylla tahavuana Jordan

"Mice" (no clue to genus)
Malaraeus bitterrootensis (Dunn)
Megabothris abantis (Rothschild)
Megarthroglossus divisus divisus (Baker)
Nosopsyllus fasciatus (Bosc d'Antic)
Orchopeas leucopus (Baker)

Muskrat, *Ondatra zibethica zibethica* (Linnaeus)
Orchopeas leucopus (Baker)

Family Muridae

Norway rat, *Rattus norvegicus* (Erxleben)
Atyphloceras multidentatus (C. Fox)
Catallagia charlottensis (Baker)
Ctenocephalides canis (Curtis)
Ctenocephalides felis felis (Bouché)
Epitedia scapani (Wagner)
Hystrichopsylla occidentalis n.sp.
Megabothris abantis (Rothschild)
Megarthroglossus procus Jordan and Rothschild
Monopsyllus ciliatus protinus (Jordan)
Micropsylla sectilis goodi Hubbard
**Nosopsyllus fasciatus* (Bosc d'Antic)
Oropsylla rupestris (Jordan)
Peromyscopsylla selenis (Rothschild)
**Xenopsylla cheopis* (Rothschild)

Black rat, *Rattus rattus rattus* (Linnaeus)
Hystrichopsylla occidentalis n.sp.
**Nosopsyllus fasciatus* (Bosc d'Antic)
**Xenopsylla cheopis* (Rothschild)

Roof rat, *Rattus rattus alexandrinus* (Geoffroy)
**Nosopsyllus fasciatus* (Bosc d'Antic)
**Xenopsylla cheopis* (Rothschild)

House mouse, *Mus musculus domesticus* Rutty
Epitedia wenmanni (Rothschild)
**Leptopsylla segnis* (Schönherr)
Micropsylla sectilis sectilis (Jordan and Rothschild)
Monopsyllus wagneri systaltus (Jordan)
Orchopeas leucopus (Baker)

Family Aplodontiidae

Brown mountain beaver, *Aplodontia rufa rufa* (Rafinesque)
Epitedia scapani (Wagner)
**Dolichopsyllus stylosus* (Baker)

Family Zapodidae

Jumping mice, *Zapus* spp.
Corrodopsylla curvata curvata (Rothschild)
**Megabothris abantis* (Rothschild)
**Megabothris quirini* (Rothschild)
Opisodasys keeni (Baker)

Idaho jumping mouse, *Zapus princeps idahoensis* Davis
Catallagia decipiens Rothschild
**Megabothris abantis* (Rothschild)

Saskatchewan jumping mouse, *Zapus princeps minor* Preble
?Epitedia wenmanni (Rothschild)
?Hystrichopsylla dippiei Rothschild
**Megabothris quirini* (Rothschild)
Monopsyllus eumolpi eumolpi (Rothschild)
Monopsyllus wagneri systaltus (Jordan)

Northwest jumping mouse, *Zapus trinotatus trinotatus* Rhoads
**Megabothris abantis* (Rothschild)

Wisconsin woodland jumping mouse, *Napaeozapus insignis frutectanus* Jackson
**Megabothris quirini* (Rothschild)
?Peromyscopsylla catatina (Jordan)

Family Erethizontidae

Alaska porcupine, *Erethizon dorsatum myops* Merriam
?Ceratophyllus adustus Jordan

Order ARTIODACTYLA

Family Cervidae

Columbian black-tailed deer, *Odocoileus hemionus columbianus* (Richardson)
?Pulex irritans Linnaeus

CLASS AVES

Order COLYMBIFORMES

Holboell's grebe, *Colymbus grisegena holboelli* (Reinhardt)
?Ceratophyllus diffinis Jordan

Order PELICANIFORMES

Cormorants, *Phalacrocorax* spp.
**Ceratophyllus niger* C. Fox

Baird's cormorant, *Phalacrocorax pelagicus resplendens* Audubon
**Ceratophyllus niger* C. Fox

Order ANSERIFORMES

"Goose"
Ceratophyllus garei Rothschild

White-winged scoter, *Melanitta deglandi* (Bonaparte)
**Ceratophyllus garei* Rothschild

Ruddy duck, *Erismatura jamaicensis rubida* (Wilson)
Ceratophyllus garei Rothschild

"Eiderdown"
Ceratophyllus garei Rothschild

Order FALCONIFORMES

Pigeon hawk, *Falco columbarius* ssp.
Monopsyllus vison (Baker)

Order GALLIFORMES

Domestic hen, *Gallus gallus*
?Ceratophyllus gallinae (Schrank)
Ceratophyllus niger C. Fox

Ruffed grouse, *Bonassa umbellus* ssp.
**Ceratophyllus diffinis* Jordan
**Ceratophyllus garei* Rothschild

Turkey, *Meleagris gallopavo* ssp.
Ceratophyllus niger C. Fox

Order CHARADRIIFORMES

California gull, *Larus californicus* Lawrence
**Ceratophyllus niger* C. Fox

Order STRIGIFORMES

Kennicott's screech owl, *Otus asio kennicotti* (Elliot)
Ceratophyllus niger C. Fox

Western burrowing owl, *Speotyto cunicularia hypugaea* (Bonaparte)
Megabothris obscurus n.sp.
Monopsyllus wagneri systaltus (Jordan)
Oropsylla idahoensis (Baker)
?Pulex irritans Linnaeus
Rectofrontia fraterna (Baker)

Long-eared owl, *Asio wilsonianus* (Lesson)
Ceratophyllus gallinae (Schrank)

Saw-whet owl, *Cryptoglaux acadica acadica* (Gmelin)
Ceratophyllus niger C. Fox

Order PICIFORMES

Red-breasted sapsucker, *Sphyrapicus varius ruber* (Gmelin)
?Dasypsyllus gallinulae perpinnatus (Baker)

Order PASSERIFORMES

Western flycatcher, *Empidonax difficilis difficilis* Baird
**Dasypsyllus gallinulae perpinnatus* (Baker)

Tree swallow, *Iridoprocne bicolor* (Vieillot)
**Ceratophyllus idius* Jordan and Rothschild

Cliff swallow, *Petrochelidon albifrons albifrons* (Rafinesque)
**Ceratophyllus petrochelidoni* Wagner

Bank swallow, *Riparia riparia riparia* (Linnaeus)
**Ceratophyllus celsus celsus* Jordan
**Ceratophyllus riparius* Jordan and Rothschild

Steller's jay, *Cyanocitta stelleri* ssp.
**Dasypsyllus gallinulae perpinnatus* (Baker)

Queen Charlotte jay, *Cyanocitta stelleri carlottae* Osgood
**Dasypsyllus gallinulae perpinnatus* (Baker)

Oregon chickadee, *Penthestes atricapillis occidentalis* (Baird)
**Dasypsyllus gallinulae perpinnatus* (Baker)

Bewick wren, *Thryomanes bewicki* ssp.
**Dasypsyllus gallinulae perpinnatus* (Baker)

Long-billed marsh wren, *Telmatodytes palustris* ssp.
**Ceratophyllus garei* Rothschild

Brown thrasher, *Toxostoma rufum* (Linnaeus)
**Ceratophyllus diffinis* Jordan

American robin, *Turdus migratorius* ssp.
**Ceratophyllus diffinis* Jordan
**Ceratophyllus niger* C. Fox
**Dasypsyllus gallinulae perpinnatus* (Baker)

Hermit thrush, *Hylocichla guttata* ssp.
**Dasypsyllus gallinulae perpinnatus* (Baker)

Russet-backed thrush, *Hylocichla ustulata ustulata* (Nuttall)
**Dasypsyllus gallinulae perpinnatus* (Baker)

Sitka kinglet, *Regulus calendula grinnelli* (Palmer)
**Dasypsyllus gallinulae perpinnatus* (Baker)

Asiatic starling, *Aethiospar cristatellus cristatellus* (Linnaeus)
Ceratophyllus niger C. Fox

Cassin's vireo, *Vireo solitarius cassini* Xantus
**Dasypsyllus gallinulae perpinnatus* (Baker)

Lutescent warbler, *Vermivora celata lutescens* (Ridgway)
**Ceratophyllus niger* C. Fox
**Dasypsyllus gallinulae perpinnatus* (Baker)

English sparrow, *Passer domesticus domesticus* (Linnaeus)
Ceratophyllus niger C. Fox

Western tanager, *Piranga ludoviciana* (Wilson)
**Dasypsyllus gallinulae perpinnatus* (Baker)

Black-headed grosbeak, *Hedymeles melanocephalus melanocephalus* (Swainson)
**Dasypsyllus gallinulae perpinnatus* (Baker)

Oregon towhee, *Pipilo maculatus oregonus* Bell
**Dasypsyllus gallinulae perpinnatus* (Baker)

Schuffeldt's junco, *Junco oreganus schuffeldti* (Coale)
**Dasypsyllus gallinulae perpinnatus* (Baker)

Harris's sparrow, *Zonotrichia querula* (Nuttall)
**Ceratophyllus garei* Rothschild

Golden-crowned sparrow, *Zonotrichia coronata* (Pallas)
**Dasypsyllus gallinulae perpinnatus* (Baker)

Song sparrows, *Melospiza melodia* ssp.
**Dasypsyllus gallinulae perpinnatus* (Baker)

Yukutat song sparrow, *Melospiza melodia caurina* Ridgway
**Dasypsyllus gallinulae perpinnatus* (Baker)

Rusty song sparrow, *Melospiza melodia morphna* Oberholser
**Ceratophyllus diffinis* Jordan

APPENDIX

A. Notes on Collecting Methods

Most of the fleas in the collection at Kamloops have been collected by shooting or trapping the hosts—shooting, in the case of birds and certain larger animals, and trapping, in the case of most of the smaller animals. At most of the animals collected are of medium to small size, the most satisfactory weapon has been found to be a double-barrelled .410 shot gun, chambered to take 3 inch shells. With a selection of 3, 2½ and 2¼ inch shells, loaded with a variety of sizes of shot from 5 down to 10 or 12, it is possible to kill a wide assortment of mammals from jackrabbitts down to chipmunks, without blowing them to pieces. If the collector is anxious to prepare study skins of some of the smaller species and finds that even the light .410 shells tend to injure the specimens unduly, a small auxilliary barrel, about 3 inches long and drilled to take .32 or .22 calibre dust shot cartridges will be invaluable. With this, tiny birds and mammals may be taken at very short ranges without being badly mutilated.

Mammals such as weasels, pocket-gophers, moles, shrews and mice are best taken in traps. Small steel traps of sizes 00 to 1, judiciously set in appropriate spots in the damp woods of the British Columbia coast will usually catch weasels, spotted skunks, red squirrels or flying squirrels. In other localities, marmots ground squirrels, wood rats, etc. may be taken in a like manner. There are specially designed traps available for catching pocket-gophers and moles.

Mouse traps of the variety known as "Museum Special" are most satisfactory for collecting shrews and the smaller rodents. They are stronger than ordinary mouse traps and have the advantage of being larger, thus tending to catch the animal across the back rather than smashing its head. This is a desirable feature if one wishes to save specimens for taxonomic purposes, for skulls should be retained as well as the skins. Anderson (1932) gives good hints on the shooting and trapping of birds and mammals, and the preparation of scientific skins.

While live traps for collecting mammals have a certain advantage in that fewer ectoparasites are lost, they are usually bulky and undesirable for that reason. Some mammal collectors recommend burying deep smooth-sided tins, or glass sealers up to their necks in suitable spots in small mammal runways, under logs, etc. When shrews are collected in this manner there is usually trouble with cannibalism—the fleas of the victims finding refuge on the surviving victor!

Once collected, the mammals or birds should be placed in paper bags, care being taken not to get specimens of more than one species in a particular bag, or the host records of the fleas will be mixed. The tops of the bags are then folded down once or twice and secured with a paper clip to prevent the loss of parasites. Upon return to the camp or laboratory, the bags may be opened, a small wad of cotton, soaked with chloroform or ether dropped in, and the bags closed again for a few minutes while the vapours stupify the fleas. The bags are then torn right open and laid out flat. The mammals are examined carefully by brushing backwards through the fur with a pair of forceps, and all the fleas (and other parasites) picked up and placed in a vial of preserving fluid (we use 70% ethyl alcohol with glycerol, 10% by volume, added). A pencilled label is placed in the vial giving catalogue number, locality, date, species and number of host animals, and the collector's name. These data are duplicated in a note book. If study skins are prepared, the same data go on the skin label,

with the same number, and any additional necessary information such as the sex and measurements of the host. This system has been used for several years at the Kamloops laboratory, and works out very satisfactorily.

When a large number of mouse traps is set out, it is best to examine the trap line several times during the night, to remove the catch and reset traps. This is an advisable procedure (unless one possesses live traps) as some fleas tend to leave the animals shortly after death. Failing this, the traps should be inspected as early as possible the following morning.

As mammals are not always killed immediately when caught, it is necessary to have some system of anchoring each trap so it cannot be dragged away. Much time may be saved in setting out a trap line if some attention has been given to this beforehand. Each of our traps has a twelve inch length of pliable brass wire fastened through a hole drilled in its baseboard. The free end of the wire is twisted into a loop. A stake about eight inches long, and made out of heavy gauge wire with a point at one end and a loop at the other is used to fasten the trap down. Each trap is set carefully in a suitable spot and the brass wire secured by driving one of the stakes through the loop and into the ground. A bit of red cloth tied into the loop of the stake makes it easy to find again. Besides this, it is advisable to make a list, or "trap chart", in a field note book, recording the location of each trap. For instance:

1. Log at bend of road, R.side.
2. 10 paces, burrow L.
3. 12 paces, under stump, R.

and so on.

It is also of great value to collect the nests of birds and mammals whenever possible as these are excellent sources of fleas. These nests should be placed in paper bags in the same manner as the animals, until there is time to examine them for parasites. A white oilcloth or white paper covering for a table, and a good bright desk lamp facilitate the tedious business of searching nests. A small portion of the nest is taken, teased out over the white surface, and examined carefully. The movements of fleas are readily detected and the insects may be picked up by means of fine forceps before they hop too far. If flea larvae are noted, it is sound practice after examination to put the nest debris back into a glass container such as a large beaker. This may be covered with voile and placed in a moderately cool humid chamber, so that the young stages may be reared through to maturity.

B. Mounting Techniques

While most fleas may be determined when prepared only as temporary fluid mounts (at other times being kept in vials of preservative) it is, in general, more satisfactory to have the specimens mounted individually as permanent microscope slide whole-mounts. Many techniques for the preparation of fleas have been tried at this laboratory, with varying success. We have finally come to the conclusion that the standard KOH-balsam mount is the most satisfactory in the long run, and does, with care, produce uniformly perfect slides. Details of this method follow.

1. Clearing

The fleas, with a tiny slip of paper bearing the file number (in pencil) are placed in a small vessel of 10% potassium hydroxide. In picking up a flea it will be found that if the forceps are not held too tightly, the insect may be lifted in a drop of fluid, and sustains no damage. Careless handling results in the loss of important setae. The fleas are allowed to stand in the KOH for about 24 hours, or somewhat longer in the case of heavily sclerotized species. It is

unnecessary to pierce the abdomens to allow the escape of opaque internal substances. If the vessels are placed in a warming oven, the clearing action may be speeded somewhat, but excessive heating is risky, as one is apt to overclear or distort the specimens.

2. Washing

Once sufficiently cleared (details of the male genitalia, and spermatheca of the female having become clearly visible) the specimens must be washed in several changes of distilled water. The fleas may be transferred from one vessel to another, or the fluids may be changed by drawing off one with a pipette, and adding another. The washing should take at least an hour and preferably longer. The last wash should contain one or two drops of acetic acid. Specimens may stand overnight in water if desired.

3. Dehydrating

The washed fleas may be transferred directly to 95% ethyl alcohol *, and left at least for an hour, and preferably overnight. Then they should be placed in absolute alcohol for half an hour or longer if necessary (thoroughly dehydrated fleas will have the sides of the abdomen collapsed together).

4. Mounting

The fleas are then placed in oil of wintergreen (15 minutes) for a final clearing, and are then mounted directly onto slides. Each flea is placed in a drop of Canada balsam (or Clarite, if one prefers), a spot of xylene added, and a cover glass slipped on. It is good practice to have all the specimens oriented in the same manner for convenience of study. According to Dampf (in litt.) fleas should be mounted on their right sides, with the legs pointed away from the technician, so that they will appear right way up and facing left when examined under the microscope. As each slide is prepared, the collection number is written on it with a wax pencil, and this is left on even when the permanent slide label is placed over it. Two labels are used on each slide, one (which we place on the left side) with the collection number and pertinent data, and the other for the identification of the flea, after it has been determined. Once a slide is prepared, 24 hours in the warming oven will hasten the setting of the balsam. It is not good practice to place a male and a female on a single slide unless one is perfectly confident that they are of the same species. Frequently, in fact usually, several species will be present in a single collection, and nothing is so aggravating as to find that one has mounted up the male of one species and the female of another on the same slide.

C. Glossary of Collectors

A.A.W. A. A. Wood, Dominion Entomological Lab., Chatham, Ont.
A.C.B. A. C. Brooks, Okanagan Landing, B.C., formerly of staff of Livestock Insects Lab., Kamloops, B.C.
A.E.C. Dr. A. E. Cameron, formerly officer in charge, Animal pathology Lab., Lethbridge, Alta.
A.L.R. Dr. A. L. Rand, Division of Biology, National Museum of Canada, Ottawa
A.P.S. Dept. National Defence, Army Plague Survey of Alberta, Saskatchewan and Manitoba, 1943
A.V.M. Prof. A. V. Mitchener, Manitoba Agricultural College
C.D.F. C. David Fowle, Dept. of Zoology, Univ. of Toronto
C.E.J. C. E. Johnston, National Museum of Canada, Ottawa.

* Direct transfer from water to 95% alcohol is considered rather drastic by some workers; however, the writer has noticed no distortion or other undesirable effects resulting from this procedure.

C.H.	C. Hynes, trapper, Parson, B.C.
C.H.D.C.	Dr. C. H. D. Clarke, Bureau of Northwest Territories and Yukon Affairs, Ottawa
C.J.G.	C. J. Guiguet, Dept. of Zoology, University of B.C.
C.L.	C. Lennox
C.N.S.	C. N. Snell, Red Deer, Alberta
C.R.T.	Dr. C. R. Twinn, Dom. Dept. of Agriculture, Div. of Entomology, Ottawa
D.C.	the late Donald Cameron, formerly of the staff of the Livestock Insects Lab., Kamloops, B.C.
D.K.C.	D. K. Campbell, Dominion Forest Insects Lab., Vernon, B.C.
D.L.	Dan Leavens, trapper, Vedder Crossing, B.C.
D.V.	D. Vockeroth, Norbury, Sask.
E.B.	E. Black, Toronto, Ont.
E.D.	Eli Davis, Charlton, Ont.
E.H.	the late Eric Hearle, formerly officer in charge of Livestock Insects Lab., Kamloops, B.C.
E.R.B.	E. R. Buckell, officer in charge of Field Crop Insects Lab., Kamloops, B.C.
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E.W.J.	E. W. Jameson Jr., Department of Zoology, Cornell University, Ithaca, N.Y.
F.B.	F. Bard, Provincial Museum, Regina, Sask.
F.H.C.	F. H. Chase, Plunkett, Sask.
F.L.B.	F. L. Beebe, Vancouver, B.C., formerly of the B. C. Plague and Spotted Fever Survey parties
F.M.S.	F. M. Shillaker, trapper, Chezakut, B.C.
G.A.M.	G. A. Mail, formerly officer in charge of Livestock Insects Lab., Kamloops, B.C.
G.C.C.	Dr. G. C. Carl, Director, Provincial Museum, Victoria, B.C.
G.C.T.	G. C. Toner
G.D.	G. Davis
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H.D.F.	H. D. Fisher, National Parks Bureau, Ottawa
H.E.McC.	H. E. McClure
H.F.H.	H. F. Hudson
H.G.F.	H. G. Fulton, Dom. Entomological Lab., Chilliwack, B.C.
H.L.	Hoyes Lloyd, Dept. of Mines and Resources, Ottawa
H.M.	H. Mobley, Salmon Arm, B.C.
H.M.L.	H. M. Laing, naturalist, Comox, B.C.
H.S.	Harry Swarth, Museum of Vertebrate Zoology, University of California, Berkeley, Calif.
H.T.F.	H. T. Fredeen, Dom. Entomological Lab., Saskatoon, Sask.
I.J.P.	I. J. Pothier
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J.P.B.	J. B. Poole, formerly of the B. C. Plague and Spotted Fever Surveys
J.C.	J. Cumming, Saskatchewan Sylvatic Plague Survey

J.D.G.	J. D. Gregson, Officer in Charge, Livestock Insects Lab., Kamloops, B.C.
J.D.S.	J. Dewey Soper, Chief Federal Migratory Bird Officer for the Prairie Provinces, Winnipeg, Man.
J.F.J.	J. F. Julian
J.F.S.F.	J. F. Stanwell-Fletcher, Philadelphia, Pa.
J.G.	J. Griffiths, Aden, Alberta
J.H.	J. Hatter, B. C. Game Commission
J.H.B.	J. H. Brown, Public Health Entomologist, Edmonton, Alta.
J.R.	John Ronayne, naturalist, Pemberton Meadows, B.C.
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K.R.	Kenneth Racey, naturalist, Vancouver, B.C.
L.C.	Father L. Coty, Arctic Red River, N.W.T.
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L.G.S.	Dr. L. G. Saunders, Dept. of Biology, University of Saskatchewan, Saskatoon, Sask.
L.J.	Leo Jobin, B. C. Game Commission, Williams Lake, B.C.
L.L.S.	?
M.S.	Miss M. Skene, Livestock Insects Lab., Kamloops, B.C.
N.C.	the late Norman Criddle, Treesbank, Man.
N.M.C.	N. M. Carter, Kamloops, B.C.
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O.P.	Dr. O. Peck, Unit of Systematic Entomology, Ottawa
P.A.T.	P. A. Taverner, formerly Dom. Ornithologist, Ottawa
P.B.	P. Bergenham, trapper, Beavermouth, B.C.
P.L.	P. Larkin, Oxford, formerly of Saskatchewan Plague Survey
P.P.	P. Petersen, formerly of staff of Livestock Insects Lab., Kamloops, B.C.
P.T.	Pierre Tazzie, trapper, Arctic Red River, N.W.T.
R.C.M.P.	Royal Canadian Mounted Police, officers of various detachments, N.W.T.
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R.G.	R. Glendenning, officer in charge, Dom. Entomological Lab., Agassiz, B.C.
R.V.W.	R. V. Whelan, Kapuscasing, Ont.
R.W.C.	Cpl. R. W. Christy, R.C.M.P., Arctic Red River, N.W.T.
S.C.	Stewart Criddle, Treesbank, Man.
S.M.	Miss S. Morton, Dom. Entomological Lab., Indian Head, Sask.
S.P.Crew	Sylvatic Plague Crews of B. C., Alta., or Sask.
T.K.M.	T. K. Moilliet, Vavenby, B.C., formerly of staff of Livestock Insects Lab., Kamloops, B.C.
T.M.S.	T. M. Shortt, artist-naturalist, Royal Ontario Museum of Zoology, Toronto, Ont.
T.N.F.	Dr. T. N. Freeman, Unit of Systematic Entomology, Ottawa
T.W.B.	T. W. Brown, Victoria, B.C.
W.D.	W. Downes, formerly officer in charge, Dom. Entomological Lab., Victoria, B.C.
W.F.	Wm. Fuller, Mammalogist, Dept. Mines and Resources, Lands Parks and Forests Branch, Fort Smith, N.W.T.
W.H.	Wm. Huxley, Livestock Insects Laboratory, Kamloops, B.C.
W.H.M.	W. H. Moore
W.R.	?

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PLATES AND FIGURES

Plate I

GENERAL ANATOMY

Fig. 1. *Monopsyllus thambus* (Jordan). Male, (Reliance, N.W.T.).

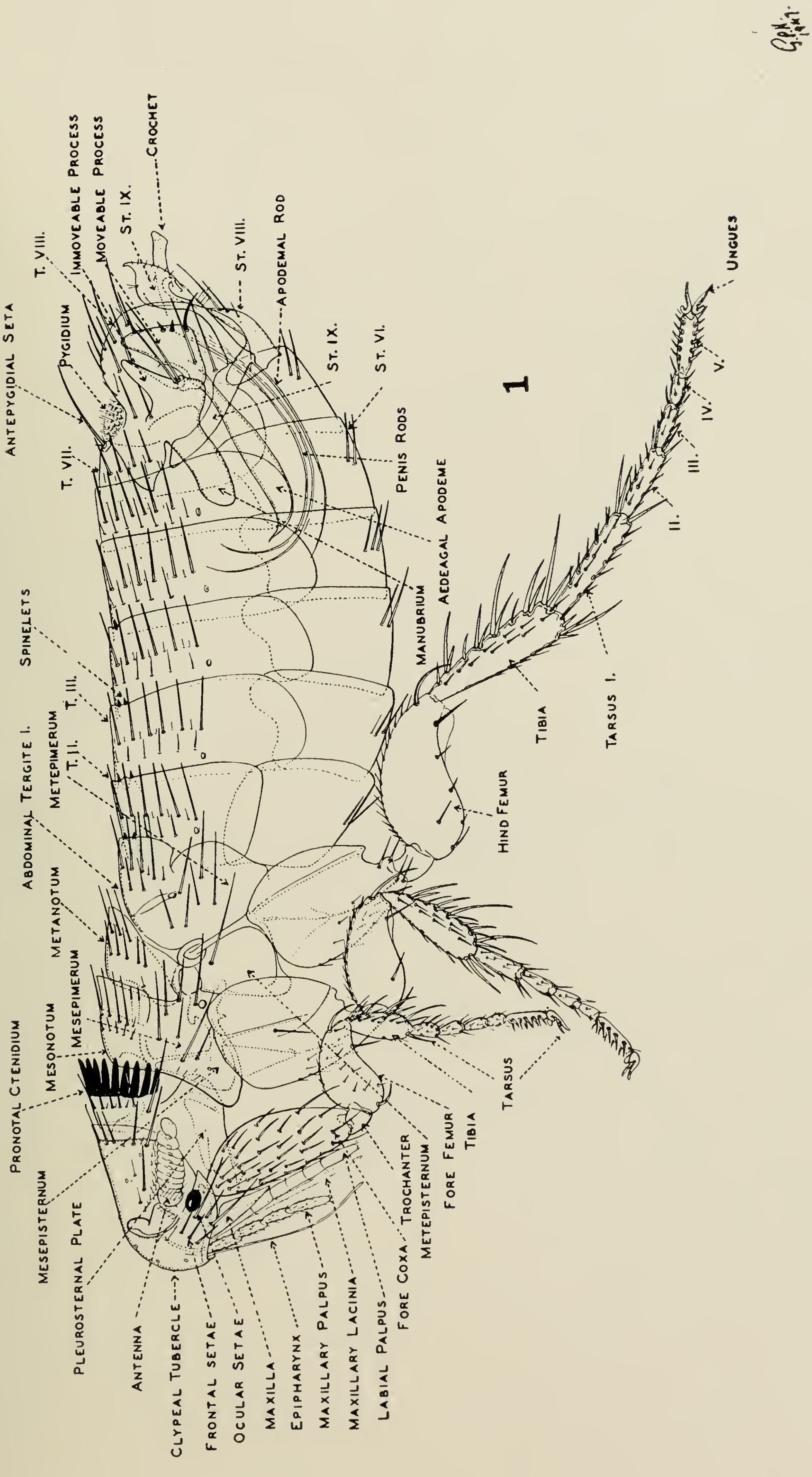

1
Pronotal Ctenidium
Mesonotum
Mesepimerum
Metanotum
Abdominal Tergite I.
Metepimerum
T. II.
T. III.
Spinelets
T. VII.
Antepygidial Seta
Pygidium
T. VIII.
Immoveable Process
Moveable Process
St. IX.
Crochet
St. VIII.
Apodemal Rod
St. IX.
St. VI.
Penis Rods
Aedeagal Apodeme
Manubrium
Tibia
Tarsus I.
II.
III.
IV.
V.
Ungues
Hind Femur
Tarsus
Tibia
Fore Femur
Metepisternum
Trochanter
Fore Coxa
Labial Palpus
Maxillary Lacinia
Maxillary Palpus
Epipharynx
Maxilla
Ocular Setae
Frontal setae
Clypeal Tubercle
Antenna
Pleurosternal Plate
Mesepisternum

PLATE II

GENERAL ANATOMY

Fig. 2. *Corrodopsylla curvata obtusata* (Wagner). Female, (Silver Creek, B.C.).

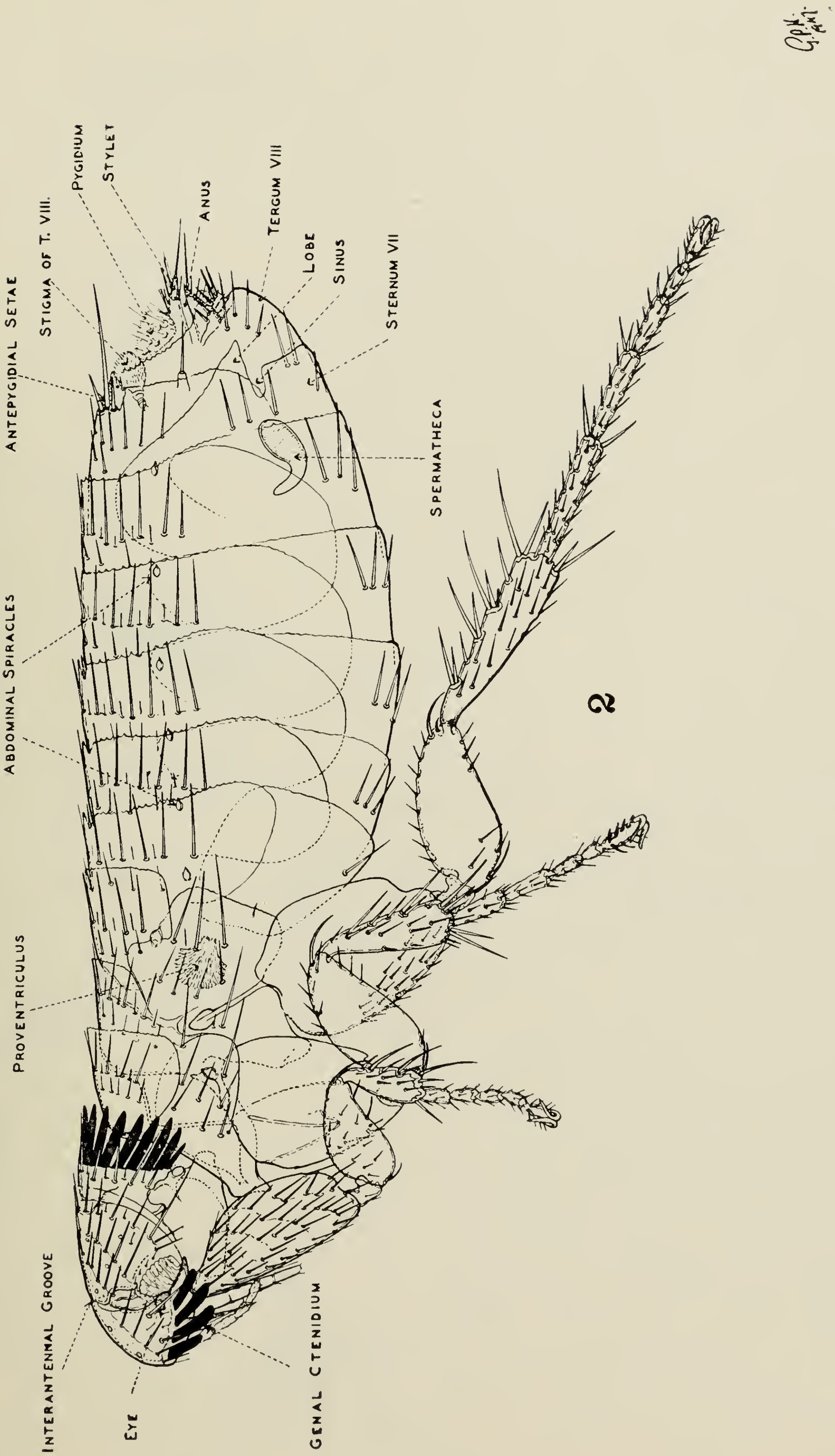
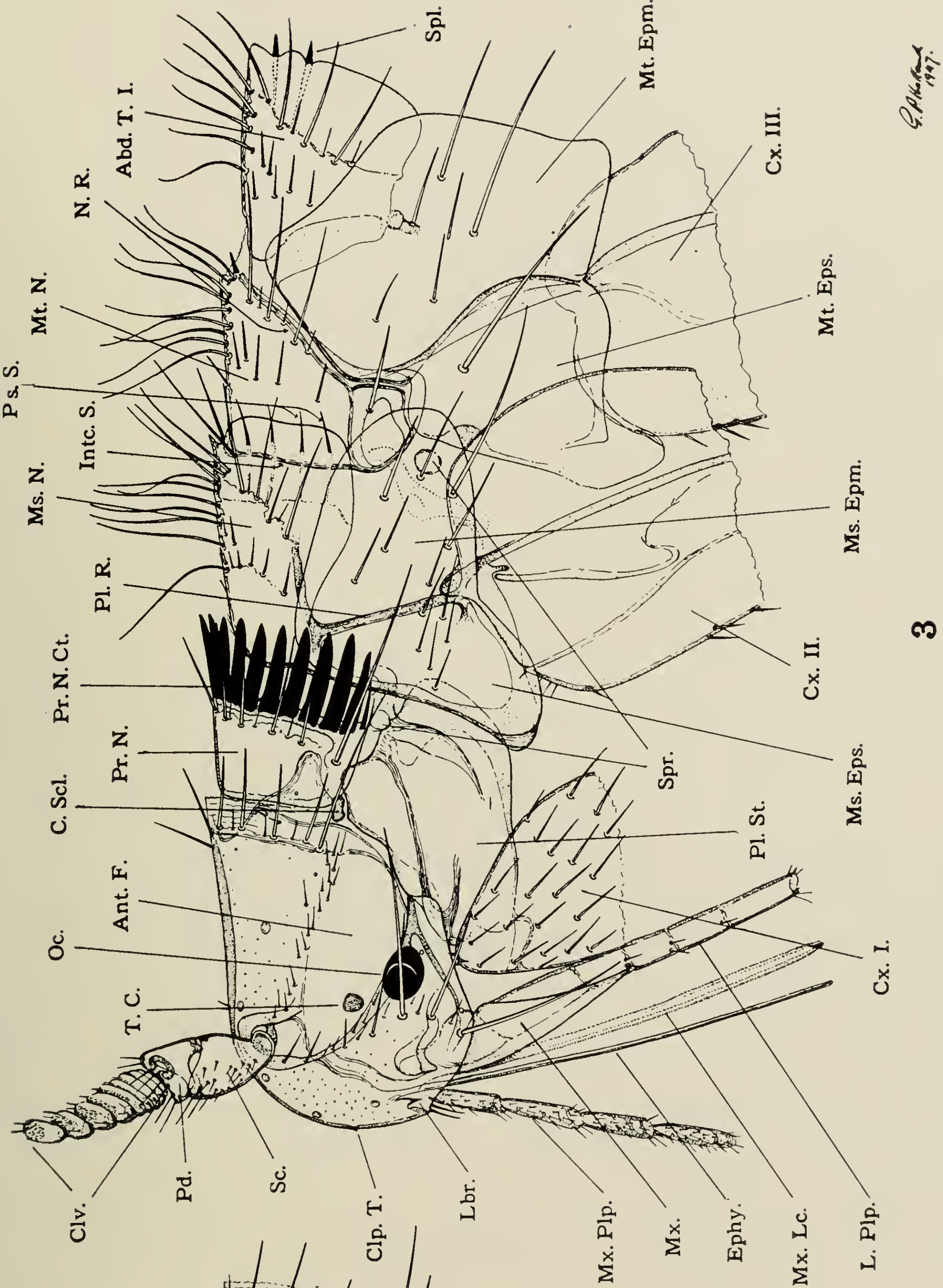

Interantennal Groove
Eye
Genal Ctenidium
Proventriculus
Abdominal Spiracles
Antepygidial Setae
Stigma of T. VIII.
Pygidium
Stylet
Anus
Tergum VIII
Lobe
Sinus
Sternum VII
Spermatheca
♀

PLATE III

GENERAL ANATOMY

Fig. 3. *Opisodasys vesperalis* (Jordan). Detail of head and thorax of male (Lac la Hache, B.C.).

Fig. 4. *O. vesperalis*. Head capsule of female (Trinity Valley, near Vernon, B.C.).


Spl.
Abd. T. I.
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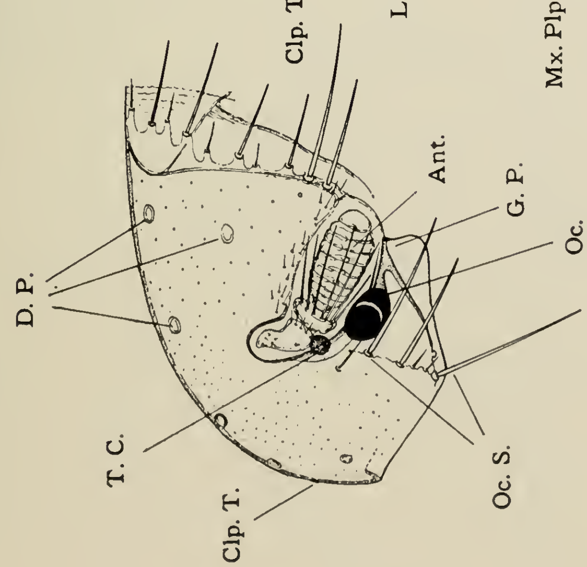
N. R.
Cx. III.
Mt. N.
Mt. Eps.
Ps. S.
Intc. S.
Ms. N.
Ms. Epm.
Pl. R.
Pr. N. Ct.
Cx. II.
Pr. N.
Spr.
Ms. Eps.
C. Scl.
Pl. St.
Ant. F.
Oc.
Cx. I.
T. C.
Clv.
Pd.
Sc.
Clp. T.
Lbr.
Mx. Plp.
Mx.
Ephy.
Mx. Lc.
L. Plp.

3


Ant.
G. P.
Oc.
D. P.
T. C.
Clp. T.
Oc. S.

4

Plate IV

GENERAL ANATOMY

Fig. 5. *Ceratophyllus niger* Fox. Detail of genitalia of male (Tatla Lake, B.C.).

Fig. 6. *C. niger*. Processes of clasper (enlarged scale).

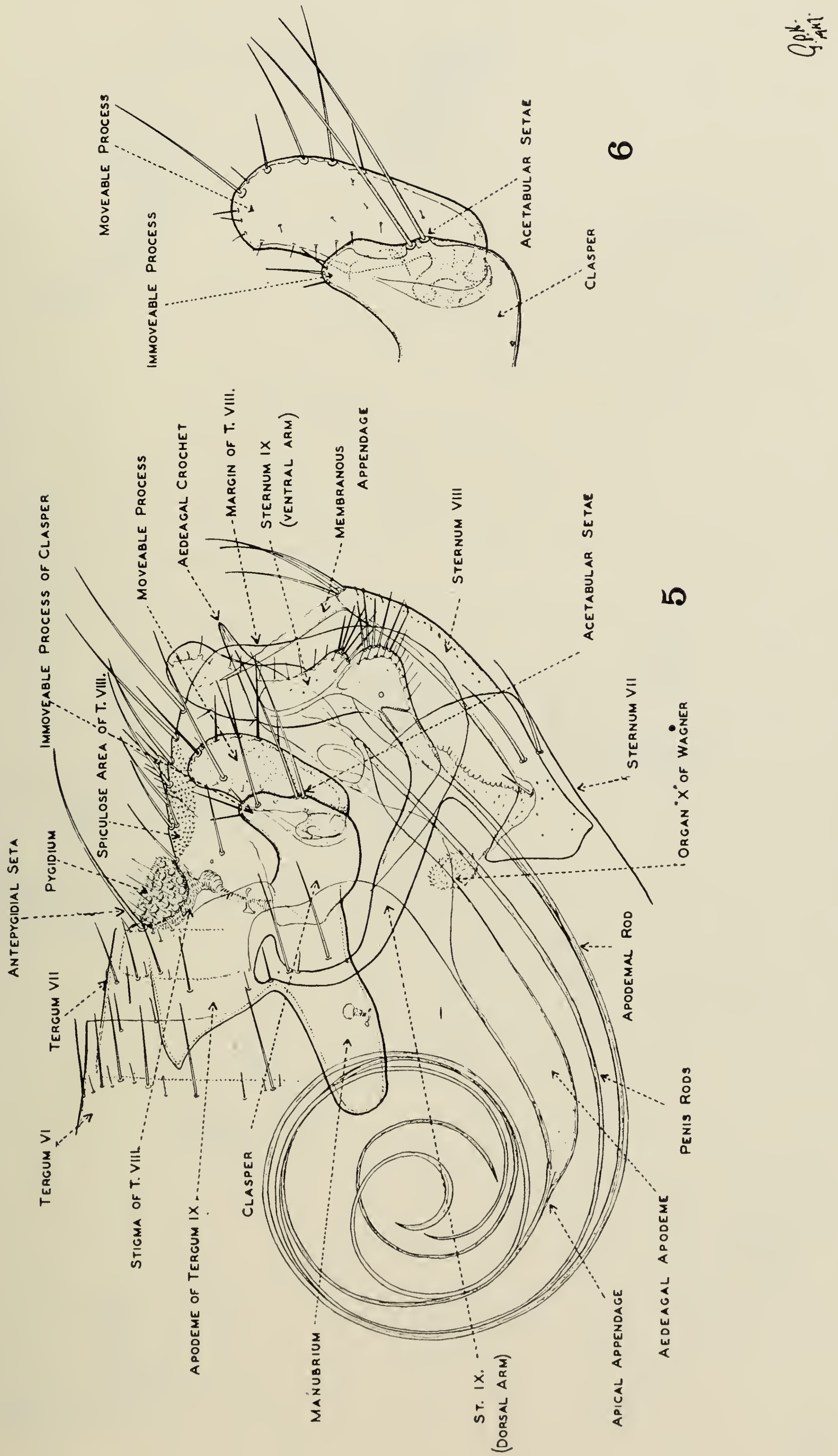

Moveable Process
Immoveable Process
Acetabular Setae
Clasper
6
Antepygidial Seta
Pygidium
Immoveable Process of Clasper
Spiculose Area of T. VIII.
Moveable Process
Aedeagal Crochet
Margin of T. VIII.
Sternum IX
(ventral arm)
Membranous
Appendage
Sternum VIII
Acetabular Setae
5
Sternum VII
Organ "X" of Wagner
Apodemal Rod
Penis Rods
Tergum VII
Tergum VI
Stigma of T. VIII.
Apodeme of Tergum IX
Clasper
Manubrium
St. IX.
(Dorsal Arm)
Apical Appendage
Aedeagal Apodeme
G.P.H.

Plate V

Family PULICIDAE

Fig. 7. *Cediopsylla simplex* (Baker). Head and pronotum of male (Electric, Ont.).

Fig. 8. *Cediopsylla inaequalis inaequalis* (Baker). Clasper of male (Elkwater, Alta.).

Fig. 9. *C. i. inaequalis.* Spermatheca of female (Waterton, Alta.).

Fig. 10. *Cediopsylla simplex* (Baker). Clasper of male (Electric, Ont.).

Fig. 11. *Ctenocephalides canis* (Curtis). Head and pronotum of male.

Fig. 12. *C. canis.* Preantennal region of head of female.

Fig. 13. *C. canis.* Clasper of male.

Fig. 14. *Ctenocephalides felis felis* (Bouché). Preantennal region of head of male.

Fig. 15. *C. f. felis.* Preantennal region of female.

Fig. 16. *C. f. felis.* Clasper of male.

Fig. 17. *C. f. felis.* Spermatheca of female.

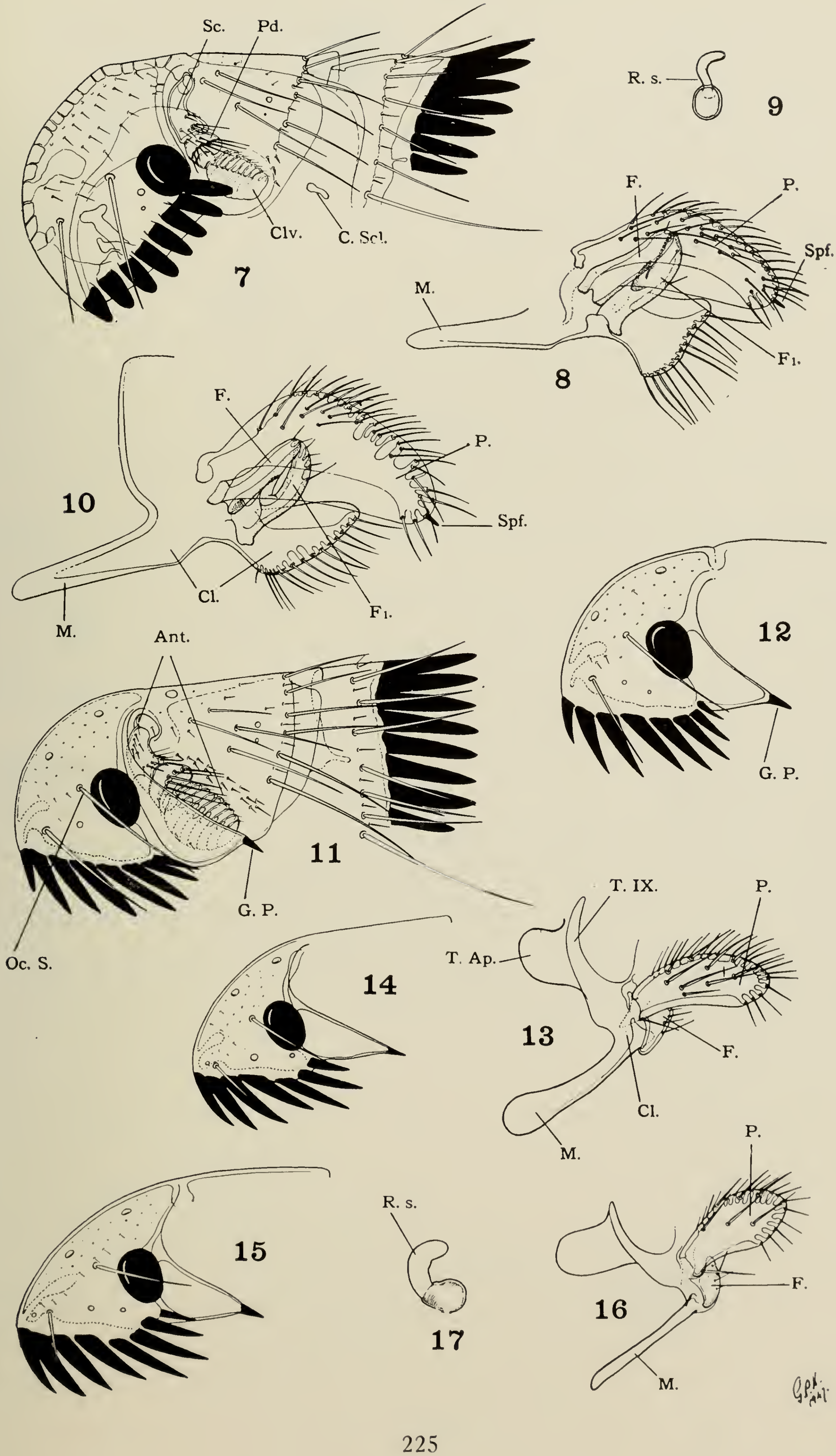

Sc.
Pd.
Clv.
C. Scl.
7
R. s.
9
F.
P.
Spf.
M.
F1.
8
F.
P.
Spf.
10
Cl.
M.
F1.
Ant.
12
G. P.
11
G. P.
Oc. S.
T. IX.
P.
T. Ap.
14
13
F.
Cl.
M.
P.
R. s.
15
F.
16
17
M.

Plate VI

Family PULICIDAE

Fig. 18. *Hoplopsyllus affinis* (Baker). Head and pronotum of male (Estevan, Sask.).

Fig. 19. *H. affinis.* Clasper and sternum IX of male.

Fig. 20. *H. affinis.* Spermatheca of female.

Fig. 21. *Hoplopsyllus glacialis lynx* (Baker). Clasper of male (Phoenix, B.C.).

Fig. 22. *H. g. lynx.* Spermatheca of female (Grey Creek, B.C.).

Fig. 23. *Pulex irritans* Linnaeus. Head and part of thorax of male (Harperville, Man.).

Fig. 24. *P. irritans.* Clasper of male.

Fig. 25. *P. irritans.* Spermatheca of female.

Fig. 26. *Xenopsylla cheopis* (Rothschild). Head and part of thorax of female.

Fig. 27. *X. cheopis.* Clasper and sternum IX of male.

Fig. 28. *X. cheopis.* Spermatheca of female.

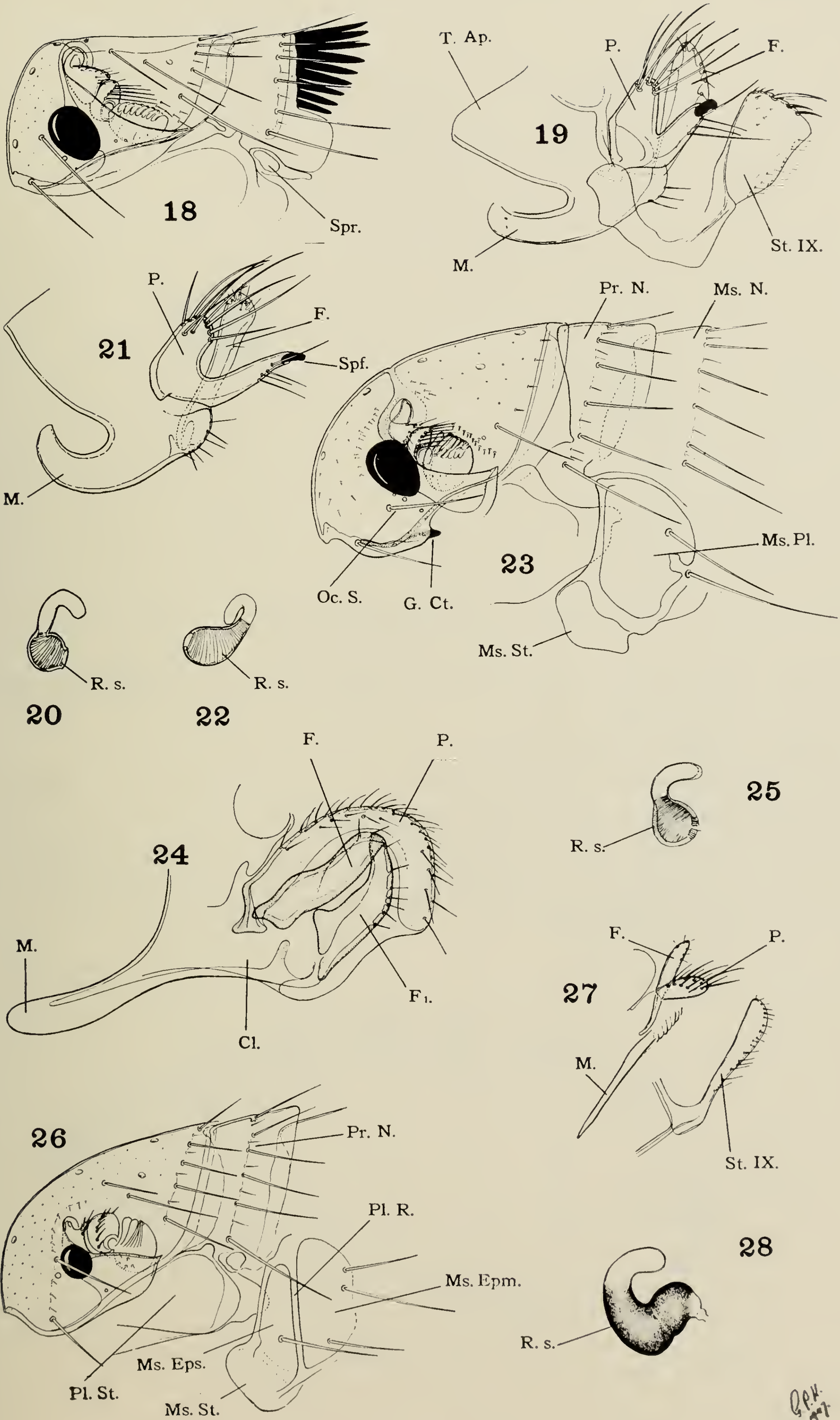

18
Spr.
19
T. Ap.
P.
F.
M.
St. IX.
21
P.
F.
Spf.
M.
23
Pr. N.
Ms. N.
Ms. Pl.
Oc. S.
G. Ct.
Ms. St.
20
R. s.
22
R. s.
24
F.
P.
M.
Cl.
F1.
25
R. s.
27
F.
P.
M.
St. IX.
26
Pr. N.
Pl. R.
Ms. Epm.
Ms. Eps.
Pl. St.
Ms. St.
28
R. s.
G.P.K.

Plate VII

Family VERMIPSYLLIDAE

Fig. 29. *Arctopsylla ursi* (Rothschild). Head and pronotum of male (Azure Lake, B.C.).

Fig. 30. *A. ursi.* Clasper of male.

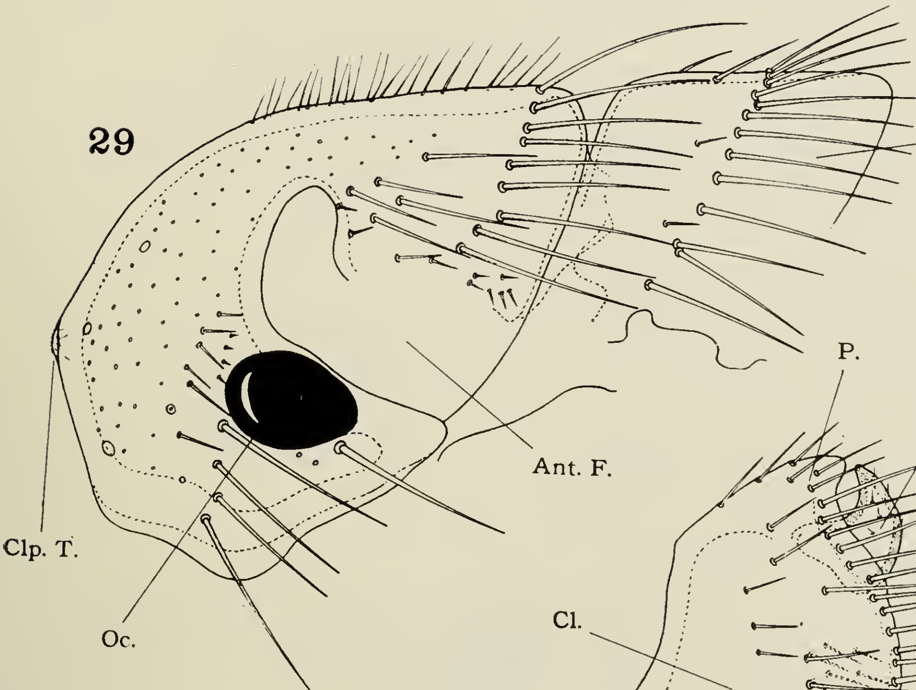
Fig. 31. *A. ursi.* Spermatheca of female.

Fig. 32. *A. ursi.* Engorged female (reduced scale).

Fig. 33. *Arctopsylla setosa* (Rothschild). Clasper of male (Malaqua, B.C.).

Fig. 34. *A setosa.* Spermatheca of female (Grey Creek, B.C.).

29



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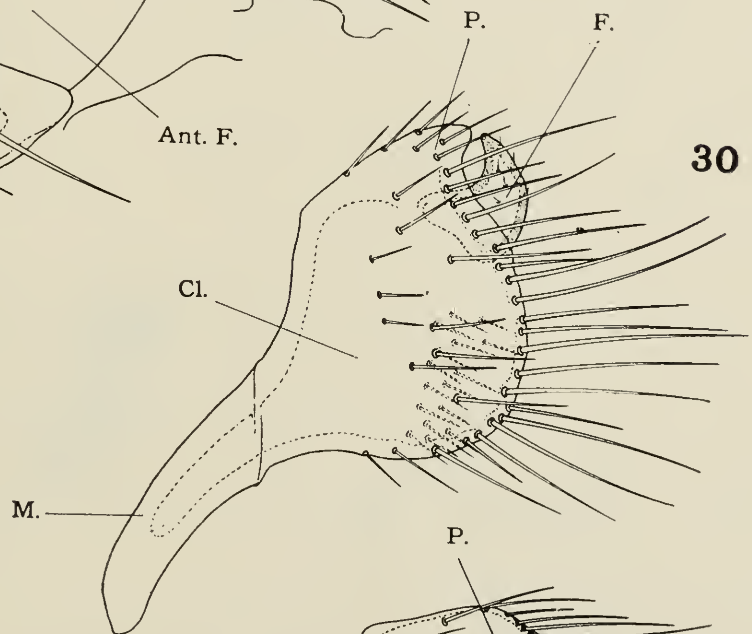

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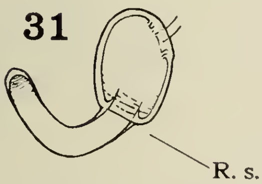

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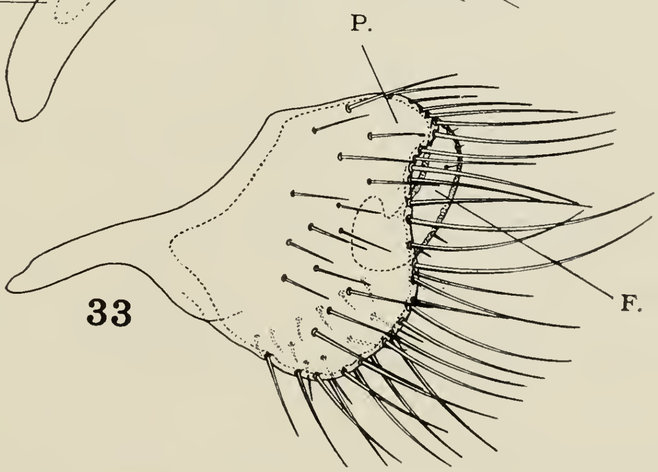

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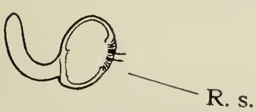


32

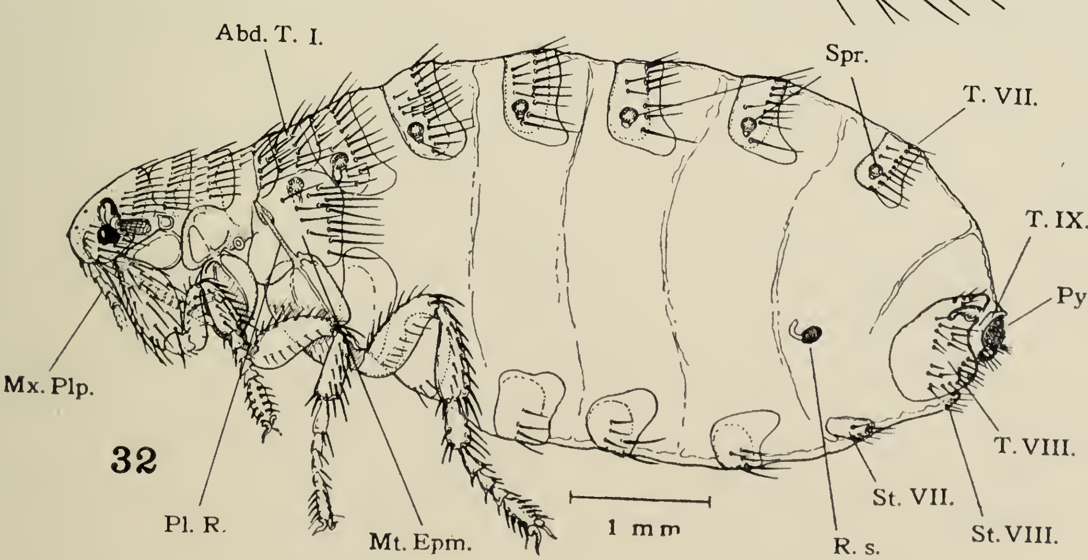


Plate VIII

Family HYSTRICHOPSYLLIDAE

Subfamily Hystrichopsyllinae

Fig. 35. *Saphiopsylla bishopi* (Jordan). Head and pronotum of male (Kapuscasing, Ont.).

Fig. 36. *S. bishopi.* Genitalia of male.

Fig. 37. *S. bishopi.* Spermathecae and sternum VII of female (Port Abino, Welland Co., Ont.).

Fig. 38. *Atyphloceras multidentatus* (Fox). Preantennal region of head of male (Chilliwack, B.C.).

Fig. 39. *A. multidentatus.* Genitalia of male.

Fig. 40. *A. multidentatus.* Spermathecae and terminal abdominal segments of female (Vancouver, B.C.).

Fig. 41. *Atyphloceras artius* (Jordan). Spermathecae and sternum VII of female (after Jordan).

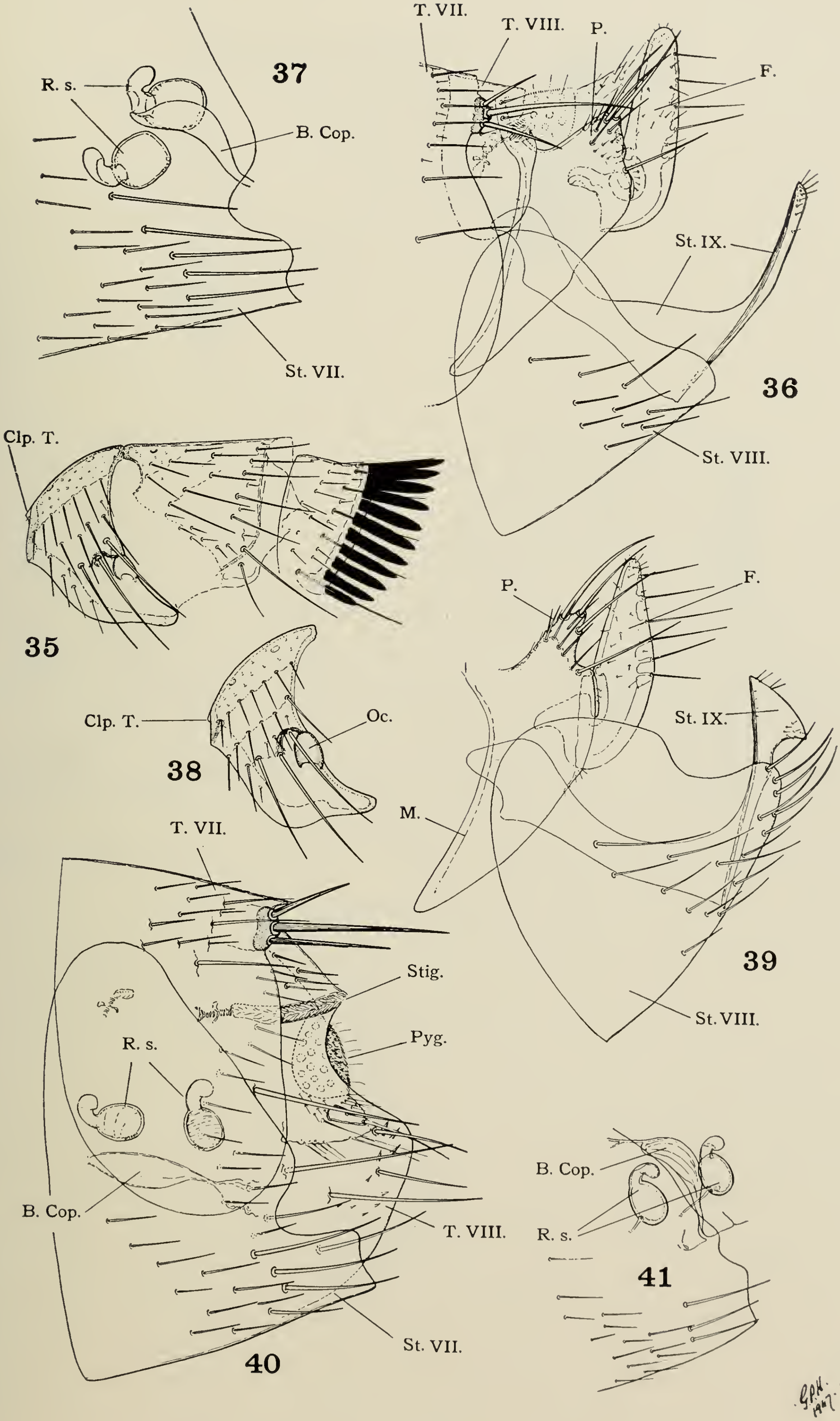

37
R. s.
B. Cop.
St. VII.
36
T. VII.
T. VIII.
P.
F.
St. IX.
St. VIII.
35
Clp. T.
38
Clp. T.
Oc.
39
P.
F.
St. IX.
M.
St. VIII.
40
T. VII.
Stig.
Pyg.
R. s.
B. Cop.
T. VIII.
St. VII.
41
B. Cop.
R. s.
G.P.H. 1947

Plate IX

Family HYSTRICHOPSYLLIDAE

Subfamily Hystrichopsyllinae

Fig. 42. *Hystrichopsylla dippiei* Rothschild. Head and pronotum of male (Stanmore, Alta.).

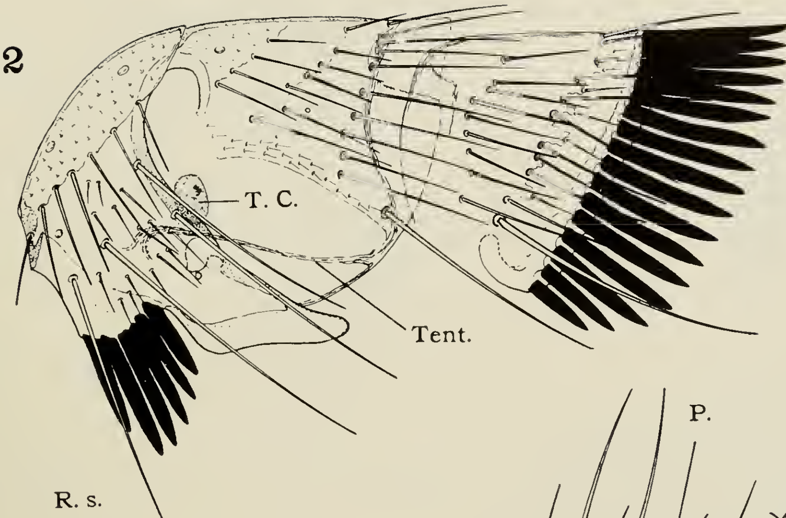
Fig. 43. *H. dippiei.* Genitalia of male.

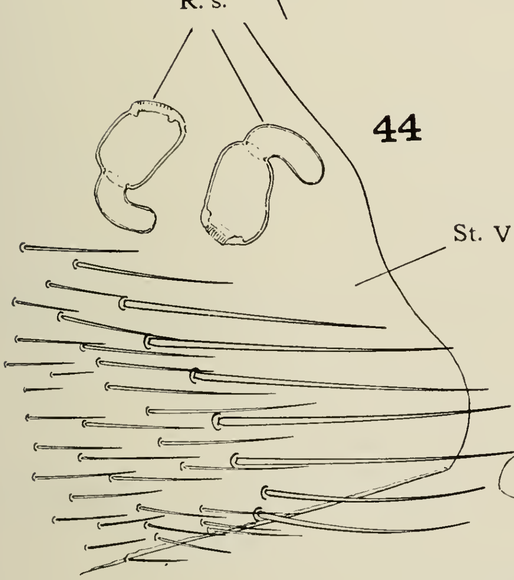
Fig. 44. *H. dippiei.* Spermathecae and sternum VII of female. (Elkwater, Alta.).

Fig. 45. *Hystrichopsylla tahavuana* Jordan. Genitalia of male (Brule Lake, Ont.).

Fig. 46. *H. tahavuana.* Spermathecae of female.

42





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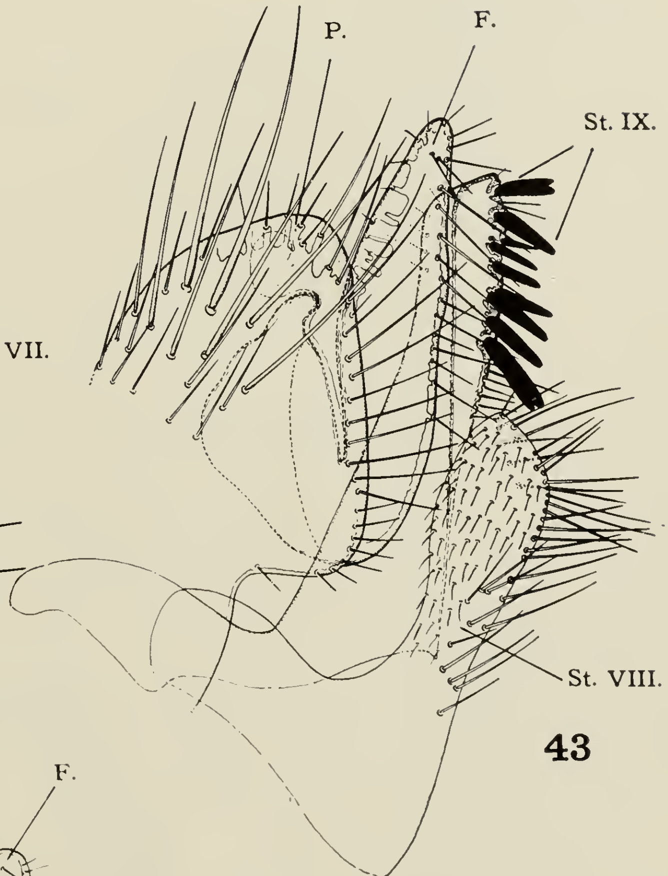
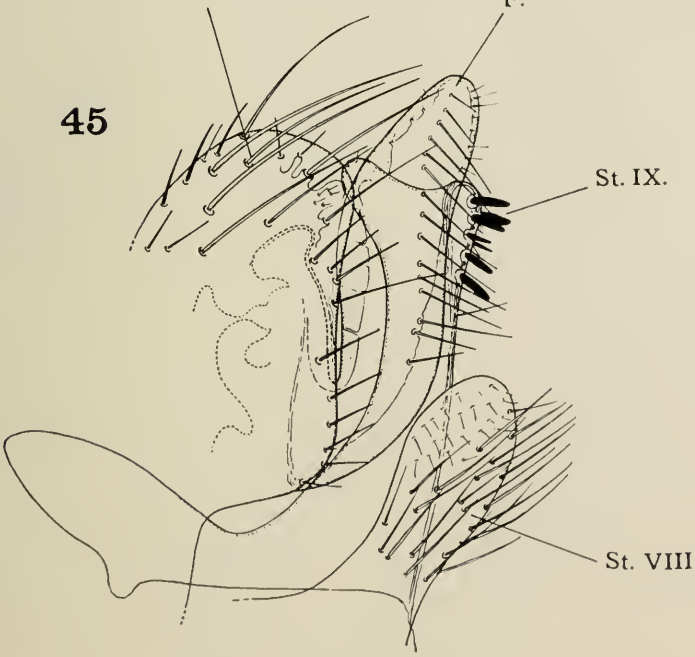
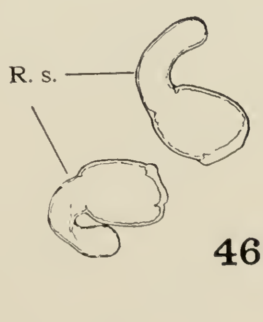


43

45





46

Plate X

Family HYSTRICHOPSYLLIDAE

Subfamily Hystrichopsyllinae

Fig. 47. *Hystrichopsylla occidentalis* n. sp. Preantennal region of head of female (allotype, Mt. Seymour, B.C.).

Fig. 48. *H. occidentalis.* Genitalia of male (holotype, Mt. Seymour, B.C.).

Fig. 49. *H. occidentalis.* Spermathecae of female (allotype).

Fig. 50. *Hystrichopsylla spinata* n. sp. Genitalia of male (holotype, Vancouver, B.C.).

Fig. 51. *H. spinata.* Enlarged detail of ventral arm of sternum VIII.

Fig. 52. *H. spinata.* Spermathecae of female (allotype, Vancouver, B.C.).

Fig. 53. *Hystrichopsylla schefferi* Chapin. Genitalia of male (Cultus Lake, B.C.).

Fig. 54. *H. schefferi.* Spermathecae of female.

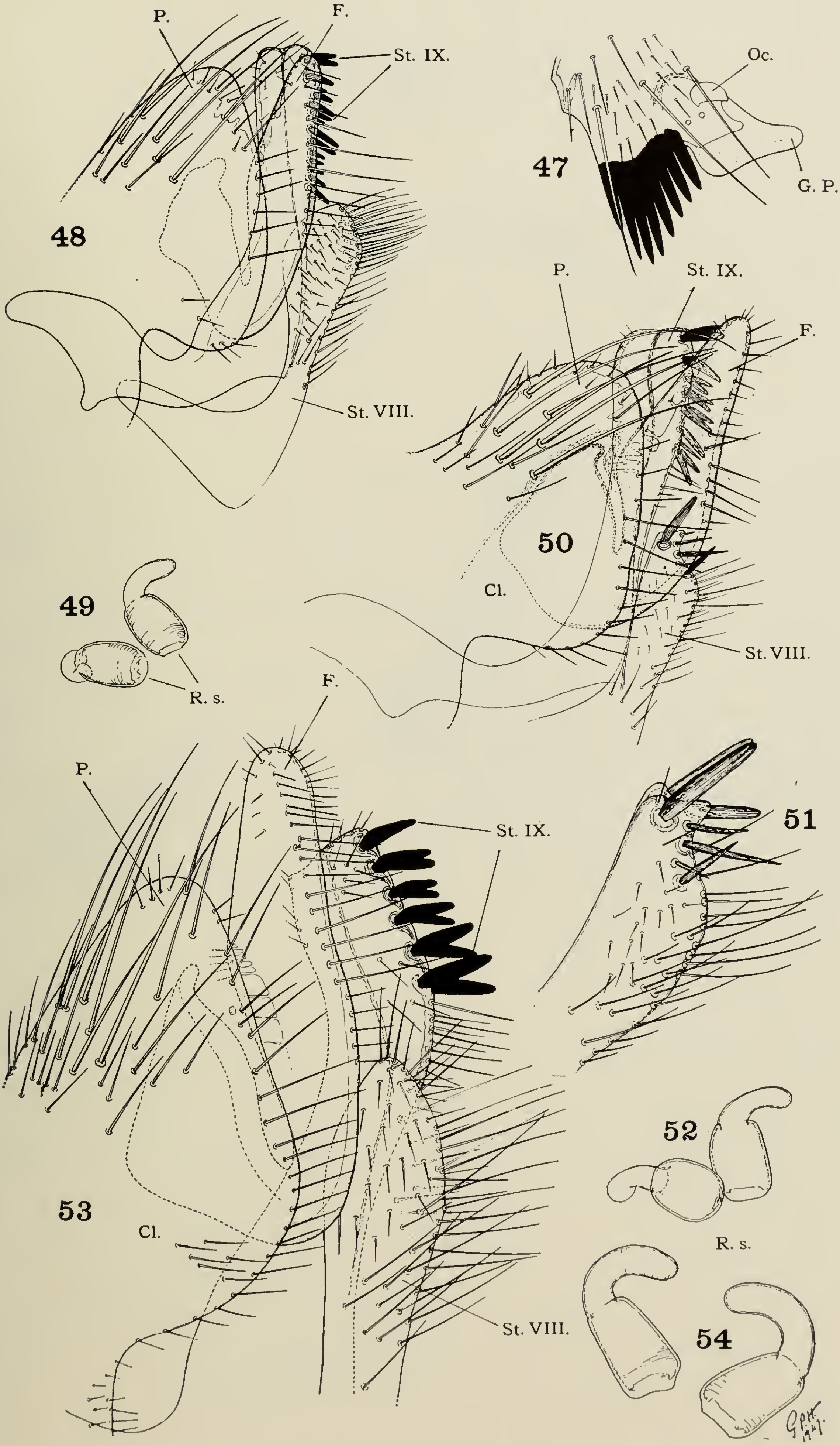

P.
F.
St. IX.
48
St. VIII.
Oc.
47
G. P.
P.
St. IX.
F.
50
Cl.
St. VIII.
49
R. s.
F.
P.
St. IX.
51
53
Cl.
St. VIII.
52
R. s.
54
G.P.H.
1947.

PLATE XI

FAMILY HYSTRICHOPSYLLIDAE

Subfamily Hystrichopsyllinae

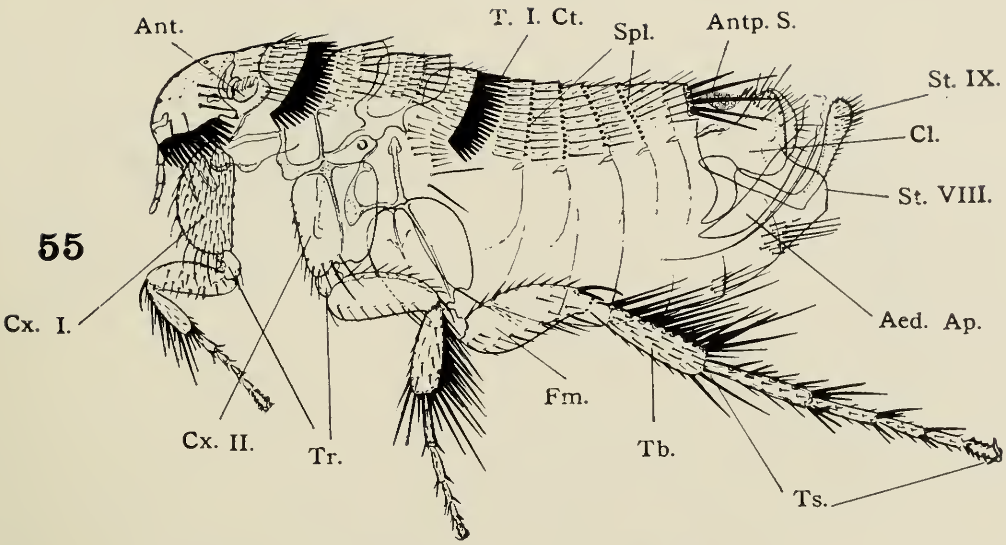
Fig. 55. *Stenoponia americana* (Baker). Male (reduced scale. Specimen from Camden, Delaware, received from Robert Traub).

Fig. 56. *S. americana*. Head and pronotum of male.

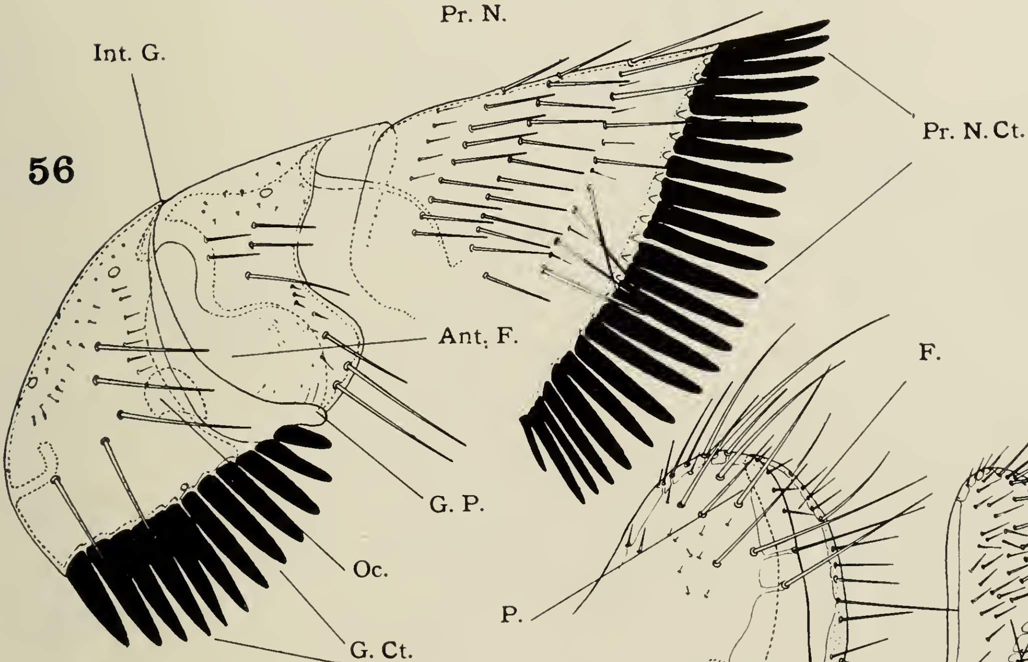
Fig. 57. *S. americana*. Clasper and sternum IX of male.

Fig. 58. *S. americana*. Spermatheca and sternum VII of female (Algoma, Ont.).

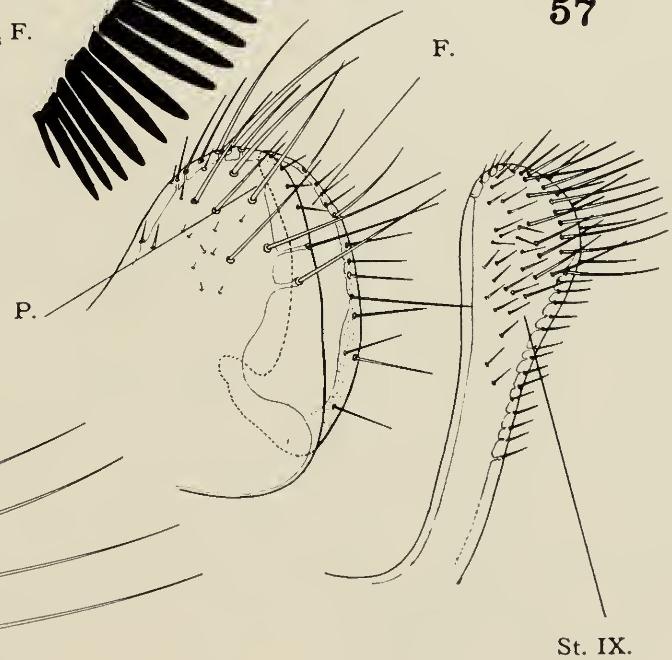
55


Ant.
T. I. Ct.
Spl.
Antp. S.
St. IX.
Cl.
St. VIII.
Aed. Ap.
Cx. I.
Cx. II.
Tr.
Fm.
Tb.
Ts.

56


Pr. N.
Int. G.
Pr. N. Ct.
Ant. F.
G. P.
Oc.
G. Ct.

57


F.
P.
St. IX.

58

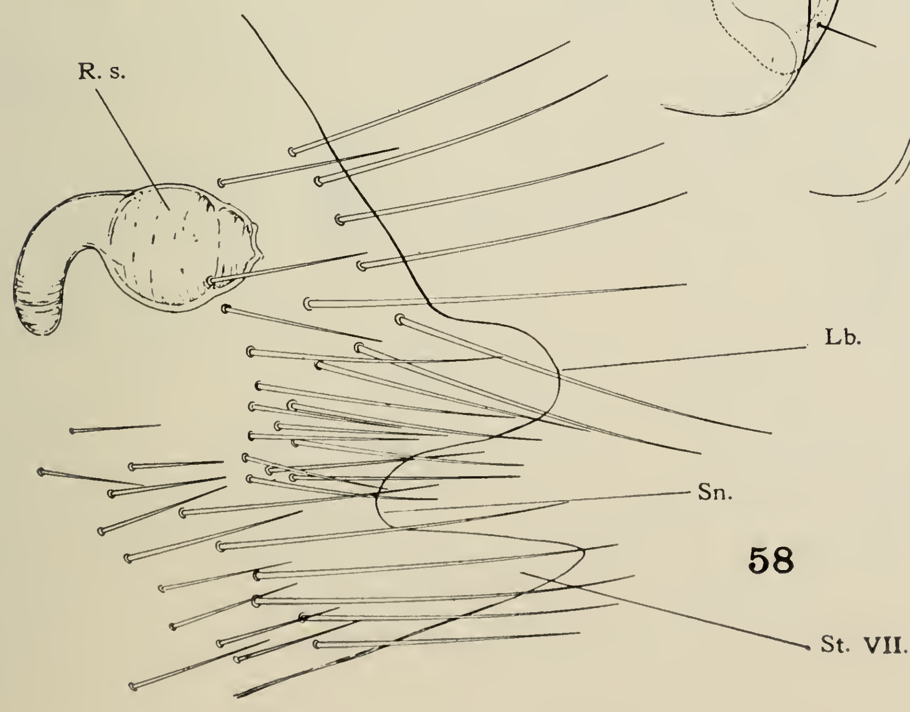

R. s.
Lb.
Sn.
St. VII.

Plate XII

Family HYSTRICHOPSYLLIDAE

Subfamily Neopsyllinae

Fig. 59. *Catallagia charlottensis* (Baker). Head and pronotum of male (Silver Creek, B.C.).

Fig. 60. *C. charlottensis*. Genitalia of male.

Fig. 61. *C. charlottensis*. Enlarged detail of ventral arm of sternum IX.

Fig. 62. *C. charlottensis*. Spermatheca and sternum VII of female.

Fig. 63. *Catallagia chamberlini* Hubbard. Coxa III and abdominal sternum II, showing "stridulating apparatus" (Tenquille Lake, B.C.).

Fig. 64. *C. chamberlini*. Ventral arm of sternum IX of male.

Fig. 65. *C. chamberlini*. Spermatheca and sternum VII of female.

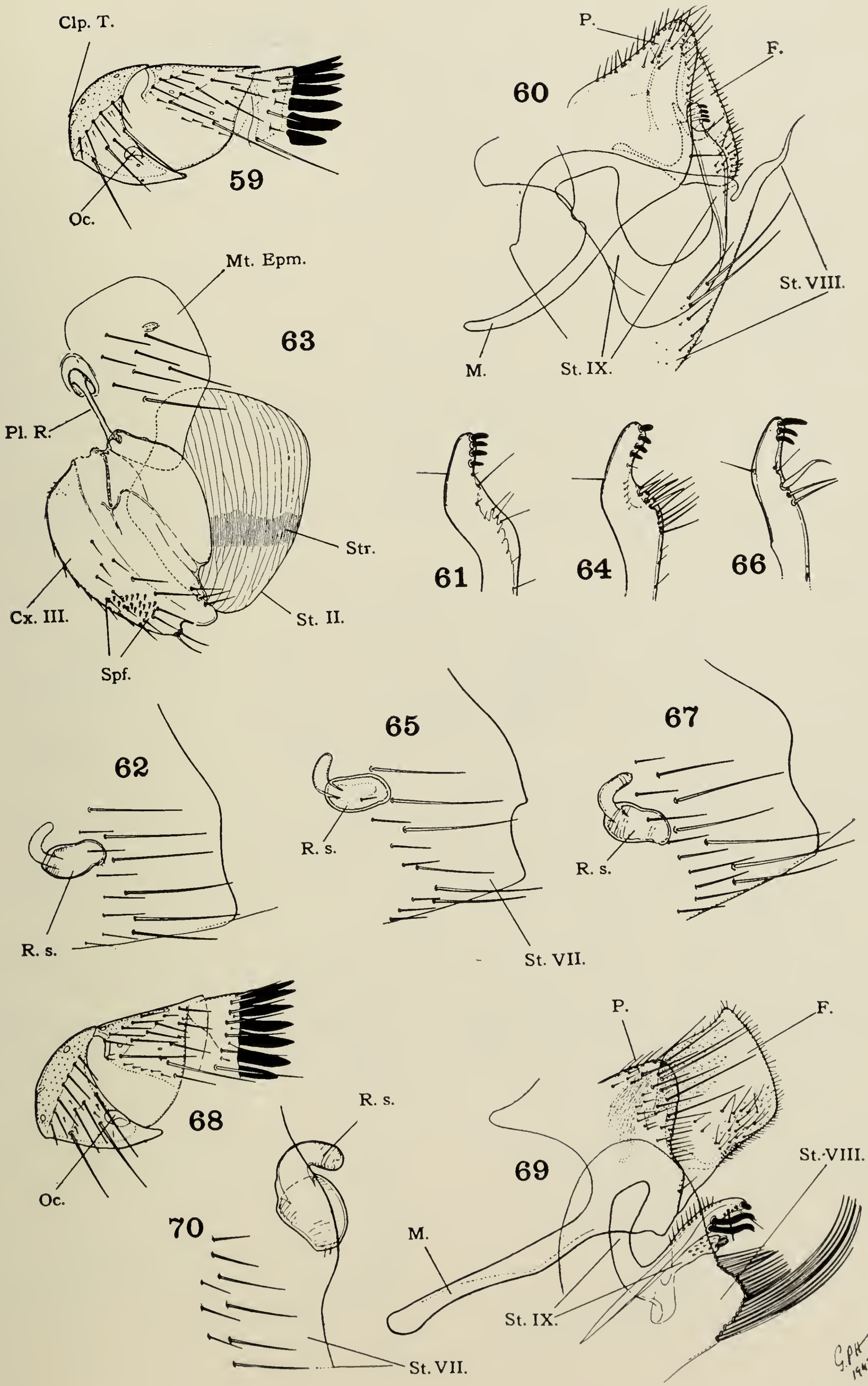
Fig. 66. *Catallagia decipiens* Rothschild. Ventral arm of sternum IX of male (Blackfalds, Alta.).

Fig. 67. *C. decipiens*. Spermatheca and sternum VII of female.

Fig. 68. *Delotelis telegoni* (Rothschild). Head and pronotum of male (Kinbasket Lake, B.C.).

Fig. 69. *D. telegoni*. Genitalia of male.

Fig. 70. *D. telegoni*. Spermatheca and sternum VII of female (Huntingdon, B.C.).



Clp. T.
Oc.
59
P.
F.
60
St. VIII.
M.
St. IX.
Mt. Epm.
63
Pl. R.
Str.
Cx. III.
St. II.
Spf.
61
64
66
62
R. s.
65
R. s.
St. VII.
67
R. s.
68
Oc.
P.
F.
69
St. VIII.
M.
St. IX.
R. s.
70
St. VII.

Plate XIII

Family HYSTRICHOPSYLLIDAE

Subfamily Neopsyllinae

Fig. 71. *Epitedia scapani* (Wagner). Head and prothorax of male (holotype, Vancouver, B.C.).

Fig. 72. *E. scapani.* Sternum IX of male (holotype).

Fig. 73. *E. scapani.* Clasper of male (holotype).

Fig. 74. *E. scapani.* Spermatheca and sternum VII of female (topotype, Vancouver, B.C.).

Fig. 75. *Epitedia wenmanni* (Rothschild). Sternum IX of male (Kamloops B.C.).

Fig. 76. *E. wenmanni.* Clasper of male.

Fig. 77. *E. wenmanni.* Spermatheca and sternum VII of female.

Fig. 78. *Neopsylla inopina* Rothschild. Head and prothorax of male (topotype; Calgary, Alta.).

Fig. 79. *N. inopina.* Clasper and sternum IX of male.

No. 80. *N. inopina.* Spermatheca and sternum VII of female (topotype).

Fig. 81. *Tamiophila grandis* (Rothschild). Spermatheca and sternum VII of female (Buckshot Lake, Ont.).

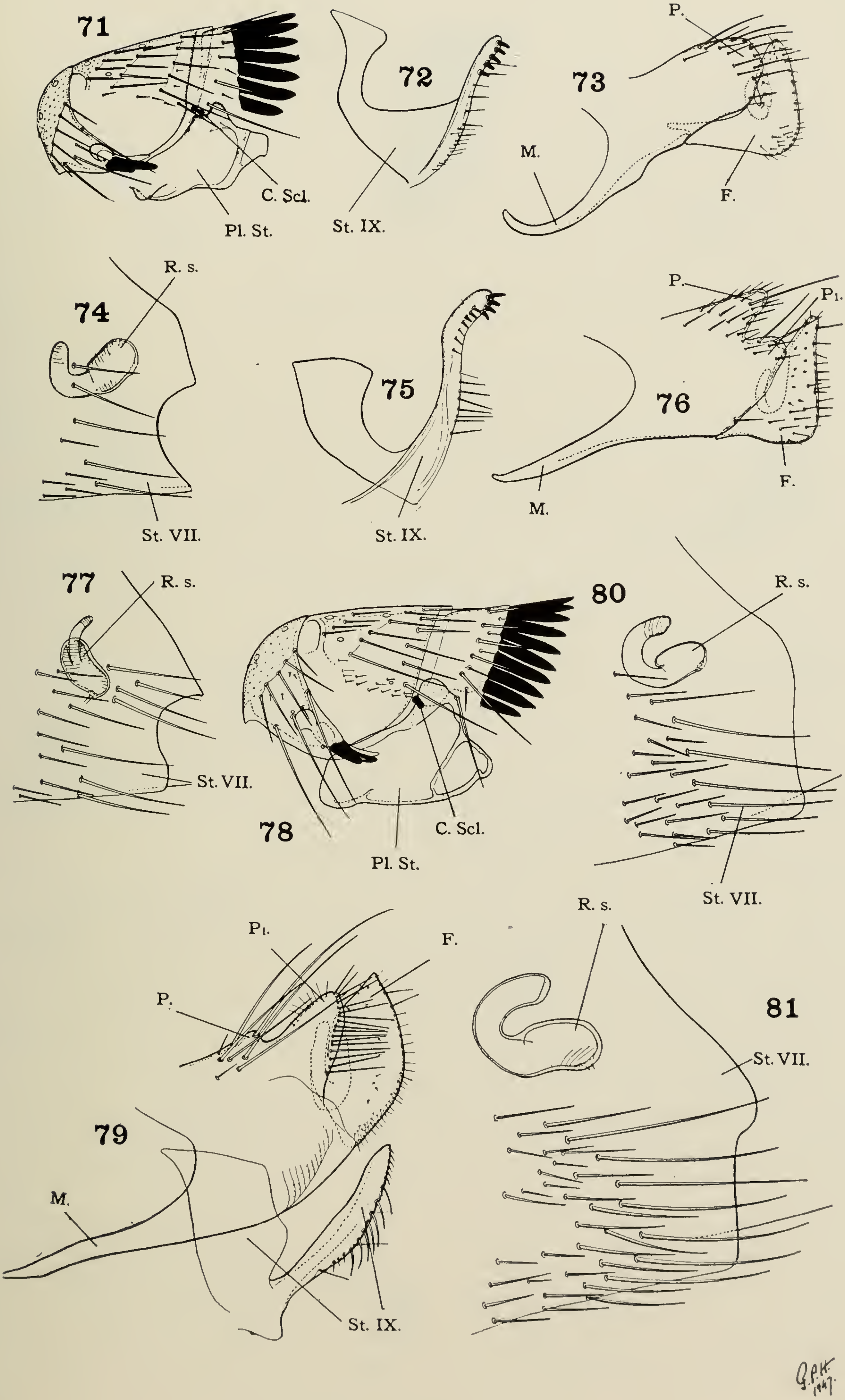

71
C. Scl.
Pl. St.
72
St. IX.
73
P.
M.
F.
74
R. s.
St. VII.
75
St. IX.
76
P.
P1.
M.
F.
77
R. s.
St. VII.
78
C. Scl.
Pl. St.
80
R. s.
St. VII.
79
P1.
F.
P.
M.
St. IX.
R. s.
81
St. VII.
G.P.H.
1947.

Plate XIV

Family HYSTRICHOPSYLLIDAE

Subfamily Neopsyllinae

Fig. 82. *Tamiophila grandis* (Rothschild). Head and pronotum of male (Pancake Bay, Algoma, Ont.).

Fig. 83. *T. grandis.* Clasper and sternum IX of male.

Fig. 84. *Meringis shannoni* (Jordan). Head and pronotum of male (Okanagan Landing, B.C.).

Fig. 85. *M. shannoni.* Hind tarsal segment V of female.

Fig. 86. *M. shannoni.* Sternum IX of male.

Fig. 87. *M. shannoni.* Clasper of male.

Fig. 88. *M. shannoni.* Spermatheca and sternum VII of female.

Subfamily Rhadinopsyllinae

Fig. 89. *Micropsylla sectilis sectilis* (Jordan and Rothschild). Head and pronotum of female (topotype; Kelowna, B.C.).

Fig. 90. *M. sectilis sectilis.* Metathorax of female.

Fig. 91. *M. sectilis sectilis.* Clasper and sternum IX of male (topotype).

Fig. 92. *M. sectilis sectilis.* Enlarged detail of moveable process of clasper of male.

Fig. 93. *M. sectilis sectilis.* Spermatheca and sternum VII of female.

Fig. 94. *Micropsylla sectilis goodi* Hubbard. Preantennal region of head of female (Vancouver, B.C.).

Fig. 95. *M. sectilis goodi.* Moveable process of clasper of male.

Fig. 96. *M. sectilis goodi.* Spermatheca and sternum VII of female.

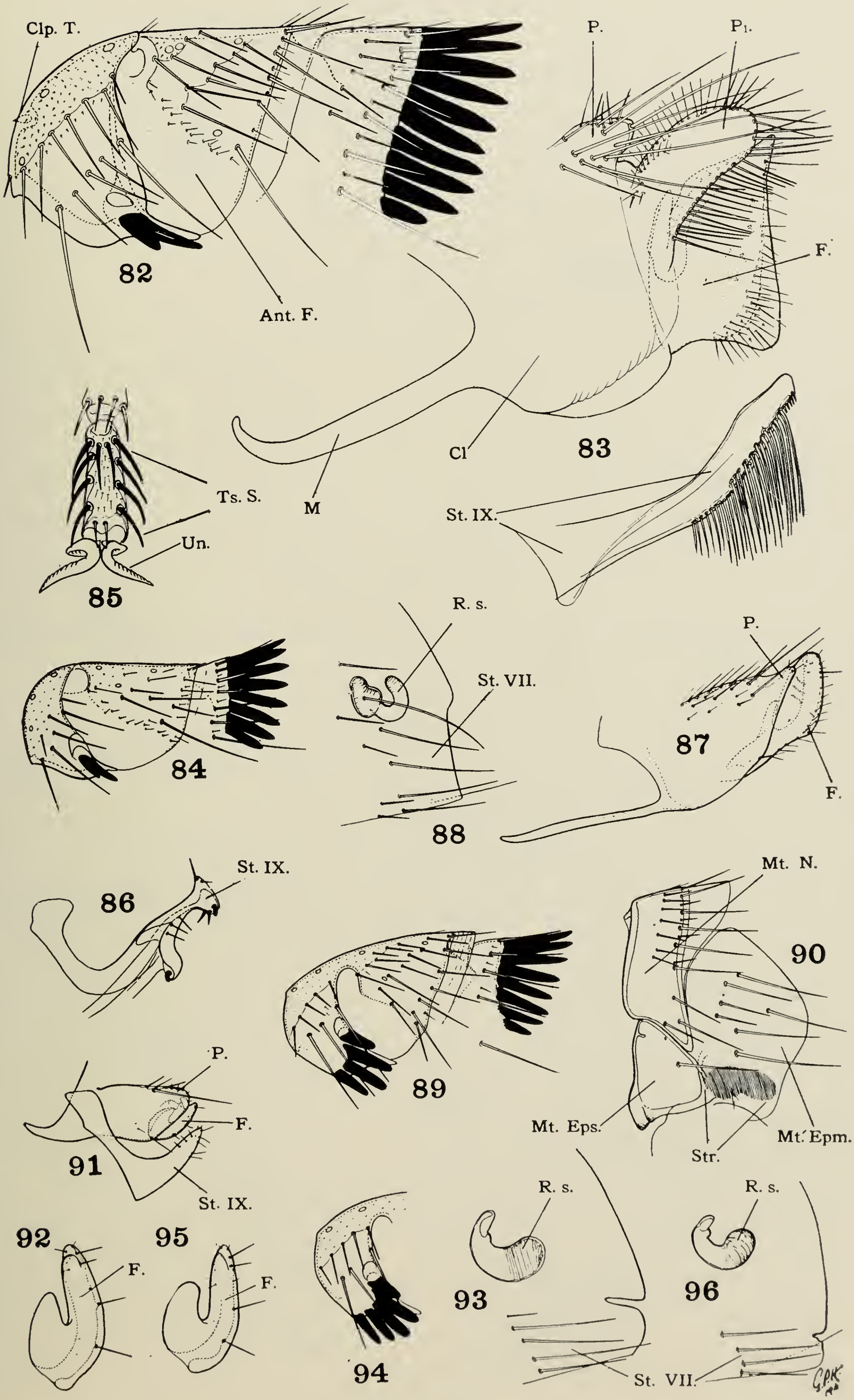

Clp. T.
P.
P1.
F.
82
Ant. F.
Cl
83
M
Ts. S.
St. IX.
Un.
85
R. s.
P.
St. VII.
87
F.
84
88
St. IX.
Mt. N.
86
90
89
Mt. Eps.
Str.
Mt. Epm.
P.
F.
91
St. IX.
R. s.
R. s.
92
95
F.
F.
93
96
94
St. VII.
G.P.K.

Plate XV

Family HYSTRICHOPSYLLIDAE

Subfamily Rhadinopsyllinae

Fig. 97. *Rectofrontia fraterna* (Baker). Head and thorax of male (Rock Glen, Sask.)

Fig. 98. *R. fraterna*. Clasper and sternum IX of male.

Fig. 99. *R. fraterna*. Spermatheca and sternum VII of female.

Fig. 100. *Trichopsylloides oregonensis* Ewing. Head and pronotum of male (Cultus Lake, B.C.).

Fig. 101. *T. oregonensis*. Metathorax of male.

Fig. 102. *T. oregonensis*. Clasper and sternum IX of male.

Fig. 103. *T. oregonensis*. Spermatheca and terminal abdominal segments of female (Clastrop Co., Oregon, specimen received from F. M. Prince).

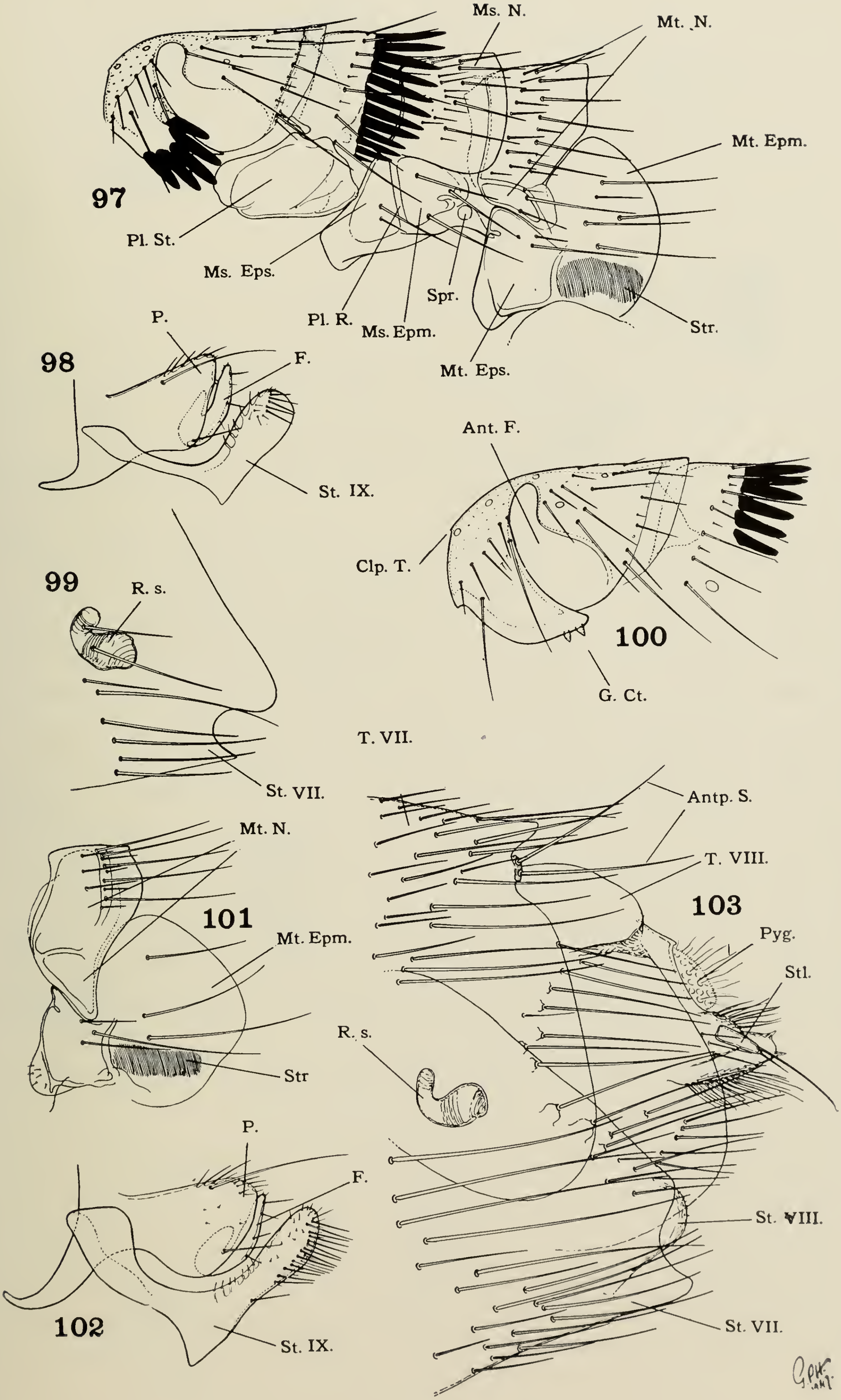

97
Ms. N.
Mt. N.
Mt. Epm.
Pl. St.
Ms. Eps.
Pl. R.
Ms. Epm.
Spr.
Str.
Mt. Eps.
98
P.
F.
St. IX.
Ant. F.
Clp. T.
100
G. Ct.
99
R. s.
St. VII.
T. VII.
Antp. S.
T. VIII.
103
Pyg.
Stl.
101
Mt. N.
Mt. Epm.
Str
R. s.
P.
F.
St. VIII.
102
St. IX.
St. VII.

Plate XVI

Family HYSTRICHOPSYLLIDAE

Subfamily Ctenophthalminae

Fig. 104. *Ctenophthalmus pseudagyrtes* Baker. Head and pronotum of male (Blackfalds, Alta.).

Fig. 105. *C. pseudagyrtes.* Terminal segments of labial palpus (enlarged scale.)

Fig. 106. *C. pseudagyrtes.* Clasper of male.

Fig. 107. *C. pseudagyrtes.* Spermatheca and sternum VII of female (Algoma, Ont.).

Fig. 108. *Doratopsylla blarinae* C. Fox. Head and pronotum of male (Algoma, Ont.).

Fig. 109. *D. blarinae.* Tergum VII and clasper of male.

Fig. 110. *D. blarinae.* Spermatheca and sternum VII of female (Algonquin Park, Ont.).

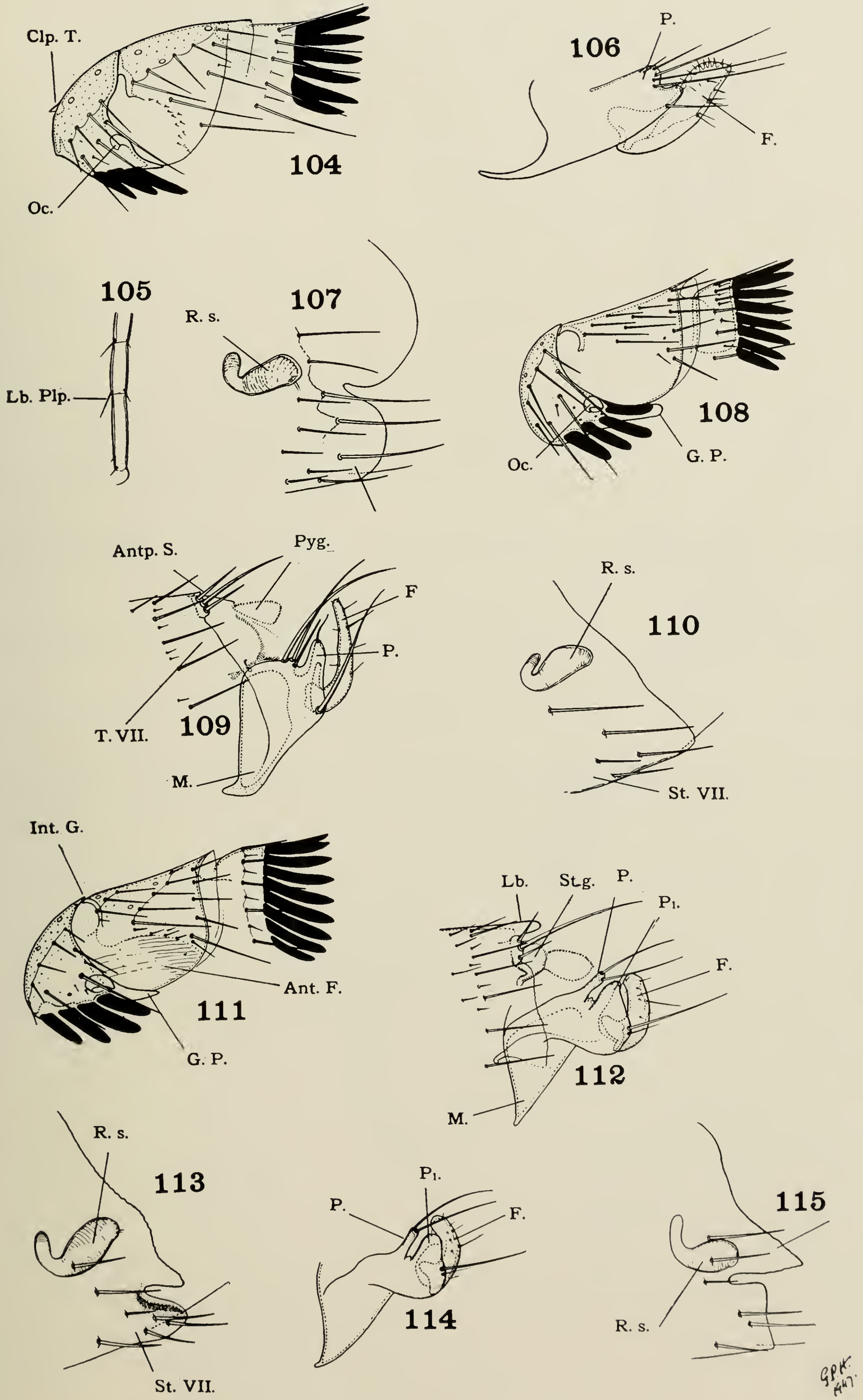
Fig. 111. *Corrodopsylla curvata curvata* (Rothschild). Head and pronotum of male (Estevan, Sask.).

Fig. 112. *C. curvata curvata.* Tergum VII and clasper of male.

Fig. 113. *C. curvata curvata.* Spermatheca and sternum VII of female.

Fig. 114. *Corrodopsylla curvata obtusata* (Wagner). Clasper of male (Chilliwack, B.C.).

Fig. 115. *C. curvata obtusata.* Spermatheca and sternum VII of female.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Oc.
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P.
F.
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Lb. Plp.
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R. s.
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Oc.
G. P.
Antp. S.
Pyg.
F
P.
T. VII.
109
M.
R. s.
110
St. VII.
Int. G.
111
Ant. F.
G. P.
Lb.
St.g.
P.
P1.
F.
112
M.
R. s.
113
St. VII.
P1.
P.
F.
114
115
R. s.
GPK. 1947.

Plate XVII

Family HYSTRICHOPSYLLIDAE

Subfamily Anomiopsyllinae

Fig. 116. *Callistopsyllus terinus* (Rothschild). Head, pronotum and fore coxa of male (Revelstoke, B.C.).

Fig. 117. *C. terinus.* Terminal abdominal segments of male.

Fig. 118. *C. terinus.* Enlarged detail of processes of clasper and posterior arm of sternum IX of male.

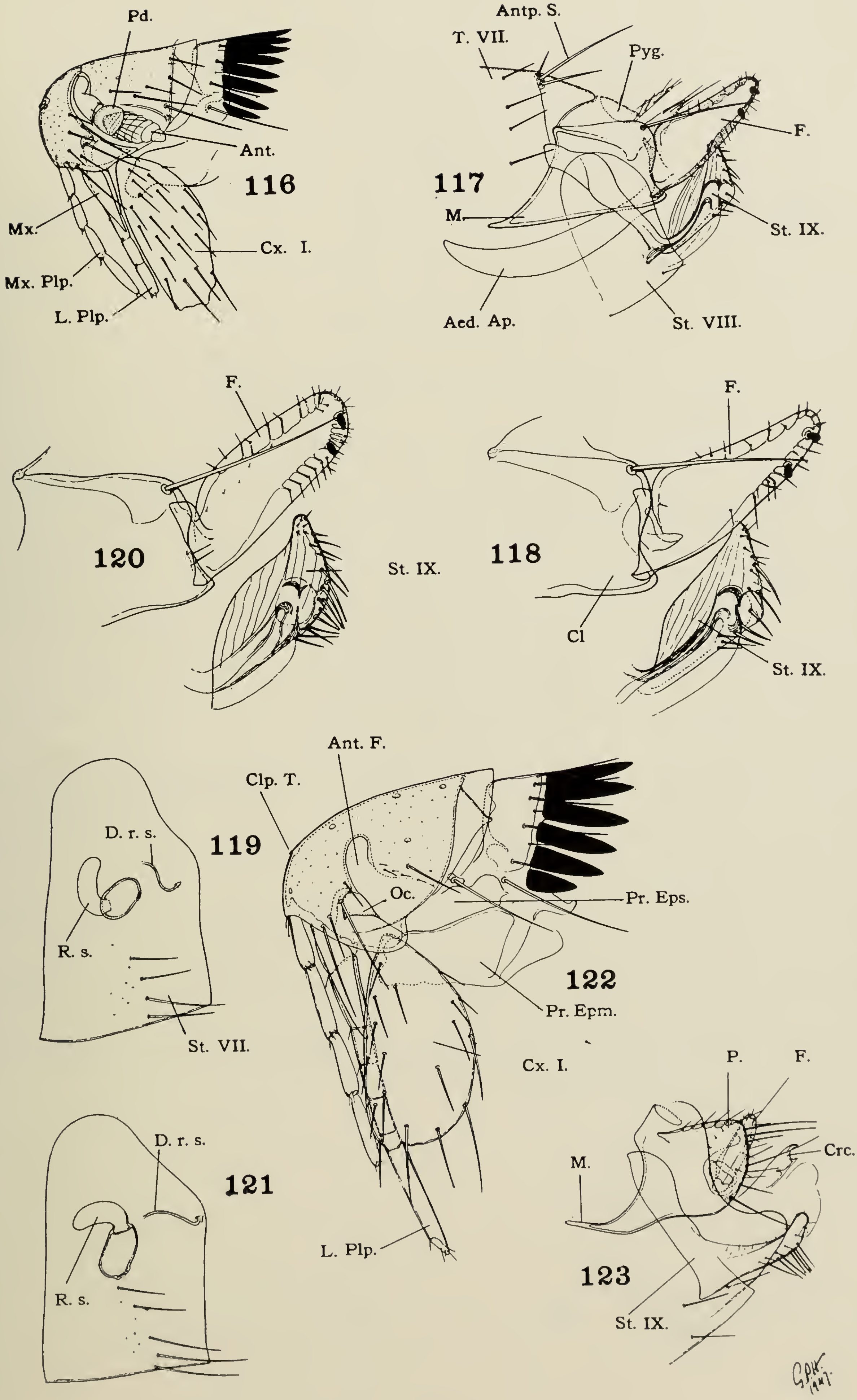
Fig. 119. *C. terinus.* Spermatheca and sternum VII of female (Kinbasket Lake, B.C.).

Fig. 120. *Callistopsyllus campestris* n. sp. Enlarged detail of processes of clasper and posterior arm of sternum IX of male (holotype; Medicine Hat, Alta.).

Fig. 121. *C. campestris.* Spermatheca and sternum VII of female (allotype; Medicine Hat, Alta.).

Fig. 122. *Megarthroglossus procus* Jordan and Rothschild. Head, pronotum and forecoxa of female (Vancouver, B.C.).

Fig. 123. *M. procus.* Genitalia of male (Gambier Island, B.C.).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T. VII.
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M.
St. IX.
Aed. Ap.
St. VIII.
F.
120
St. IX.
F.
118
Cl
St. IX.
Ant. F.
Clp. T.
D. r. s.
119
Oc.
Pr. Eps.
R. s.
122
Pr. Epm.
St. VII.
Cx. I.
P.
F.
D. r. s.
Crc.
121
M.
L. Plp.
R. s.
123
St. IX.

Plate XVIII

Family HYSTRICHOPSYLLIDAE

Subfamily Anomiopsyllinae

Fig. 124. *Megarthroglossus procus* Jordan and Rothschild. Spermatheca and sternum VII of female (Vancouver, B.C.).

Fig. 125. *Megarthroglossus similis* Wagner. Genitalia of male (after Wagner).

Fig. 126. *Megarthroglossus divisus divisus* (Baker). Genitalia of male (Berg Lake, Mt. Robson, B.C.).

Fig. 127. *M. d. divisus.* Spermatheca and sternum VII of female.

Fig. 128. *Megarthroglossus divisus exsecatus* Wagner. Genitalia of male (Rayleigh, B.C.).

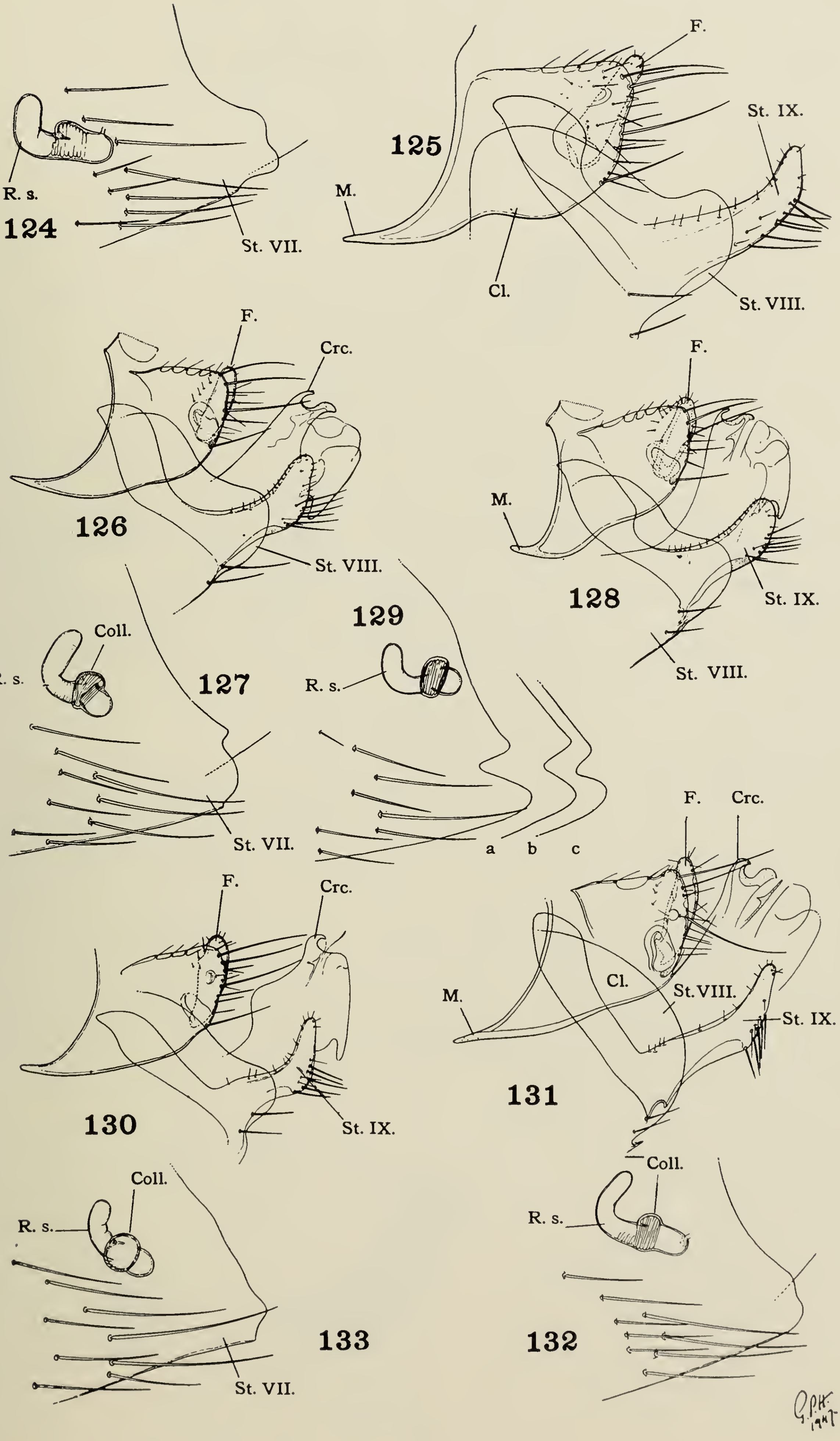
Fig. 129. *M. divisus exsecatus.* Spermatheca and sternum VII of female (a Rayleigh, B.C.; b, holotype, Avola, B.C.; c, Nicola, B.C., a specimen checked by Wagner).

Fig. 130. *Megarthroglossus pygmaeus* Wagner. Genitalia of male (holotype, Nicola, B.C.).

Fig. 131. *Megarthroglossus sicamus* Jordan and Rothschild. Genitalia of male (after Jordan and Rothschild).

Fig. 132. *M. sicamus.* Spermatheca and sternum VII of female (Rutland, B.C.).

Fig. 133. *Megarthroglossus spenceri* Wagner. Spermatheca and sternum VII of female (holotype, Nicola, B.C.).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Cl.
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Crc.
St. VIII.
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Coll.
R. s.
St. VII.
128
F.
M.
St. IX.
St. VIII.
129
R. s.
a
b
c
130
F.
Crc.
St. IX.
131
F.
Crc.
M.
Cl.
St. VIII.
St. IX.
132
Coll.
R. s.
133
Coll.
R. s.
St. VII.

Plate XIX

Family HYSTRICHOPSYLLIDAE

Subfamily Anomiopsyllinae

Fig. 134. *Conorhinopsylla stanfordi* Stewart. Head and pronotum of male (Michigan; specimen received from Wm. L. Jellison).

Fig. 135. *C. stanfordi.* Genitalia of male.

Fig. 136. *C. stanfordi.* Spermatheca and sternum VII of female (Michigan; specimen from Wm. L. Jellison).

Subfamily Nearctopsyllinae

Fig. 137. *Corypsylla ornata* Fox. Head and thorax of male (Agassiz, B.C.).

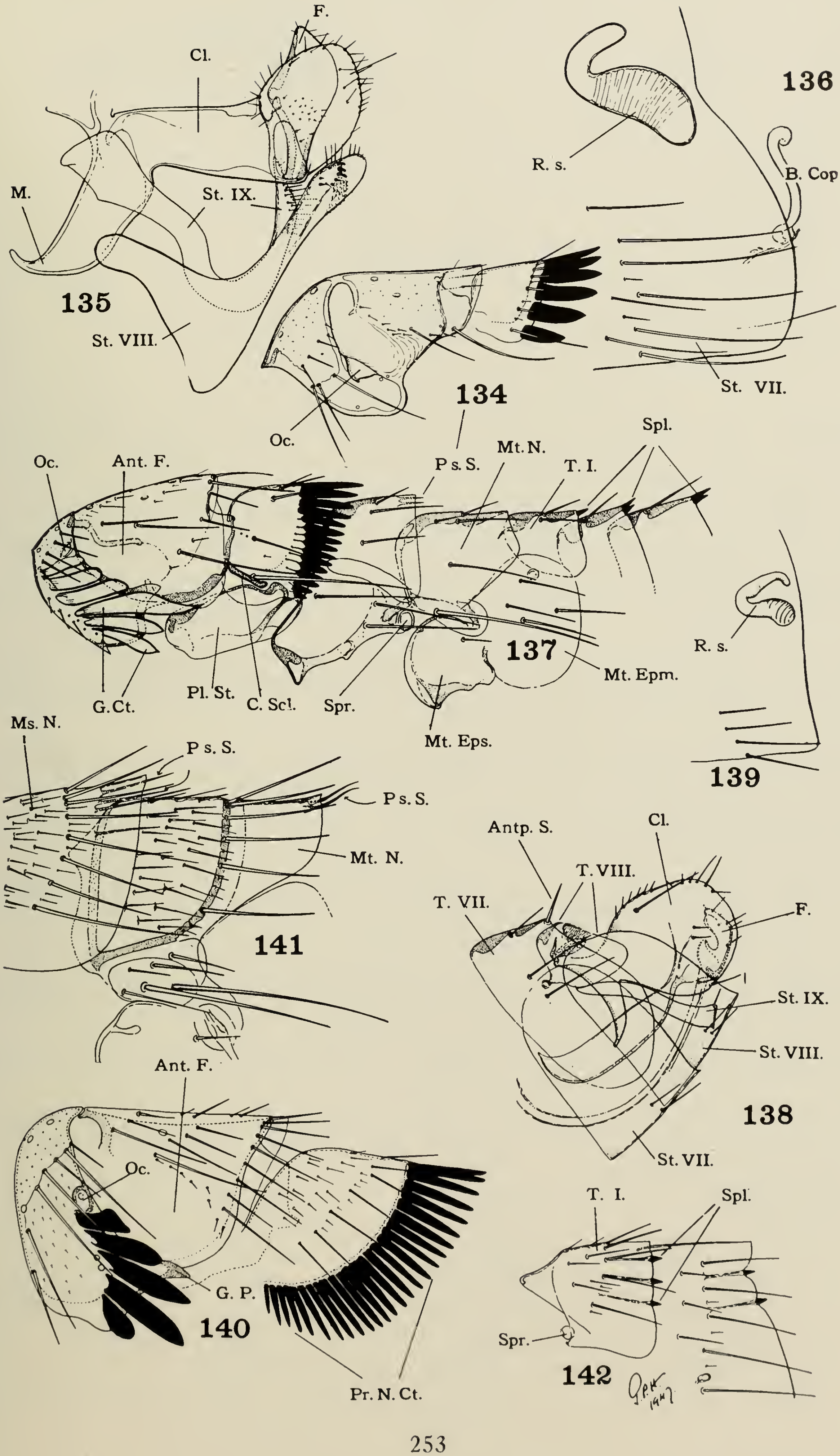
Fig. 138. *C. ornata.* Genitalia of male.

Fig. 139. *C. ornata.* Spermatheca and sternum VII of female (Silver Creek, B.C.).

Fig. 140. *Nearctopsylla brooksi* (Rothschild). Head and pronotum of male (Beavermouth, B.C.).

Fig. 141. *N. brooksi.* Meso- and metanotum of female (Cultus Lake, B.C.).

Fig. 142. *Nearctopsylla hyrtaci* (Rothschild). Abdominal terga I and II, showing apical spinelets. Male (Vavenby, B.C.).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B. Cop
St. VII.
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Oc.
Ant. F.
Ps. S.
Mt. N.
T. I.
Spl.
137
Mt. Epm.
R. s.
G. Ct.
Pl. St.
C. Scl.
Spr.
Mt. Eps.
Ms. N.
Ps. S.
Ps. S.
Mt. N.
139
141
Antp. S.
Cl.
T. VIII.
T. VII.
F.
St. IX.
St. VIII.
138
St. VII.
Ant. F.
Oc.
G. P.
140
Pr. N. Ct.
T. I.
Spl.
Spr.
142
G.P.K. 1947

Plate XX

Family HYSTRICHOPSYLLIDAE

Subfamily Nearctopsyllinae

Fig. 143. *Nearctopsylla brooksi* (Rothschild). Processes of clasper and sternum IX of male (Paradise Mine, B.C.).

Fig. 144. *N. brooksi.* Spermatheca and sternum VII of female.

Fig. 145. *Nearctopsylla hyrtaci* (Rothschild). Processes of clasper and sternum IX of male (Vavenby, B.C.).

Fig. 146. *N. hyrtaci.* Spermatheca and sternum VII of female (Cultus Lake, B.C.).

Fig. 147. *Nearctopsylla genalis genalis* (Baker). Moveable process of clasper and ventral arm of sternum IX (Drawn from the type male, by Robert Traub). Enlarged scale.

Fig. 148. *Nearctopsylla genalis hygini* (Rothschild). Moveable process and ventral arm of sternum IX (Pierce Lake, Sask.).

Fig. 149. *N. genalis hygini.* Sternum VII of female (after Jordan and Rothschild).

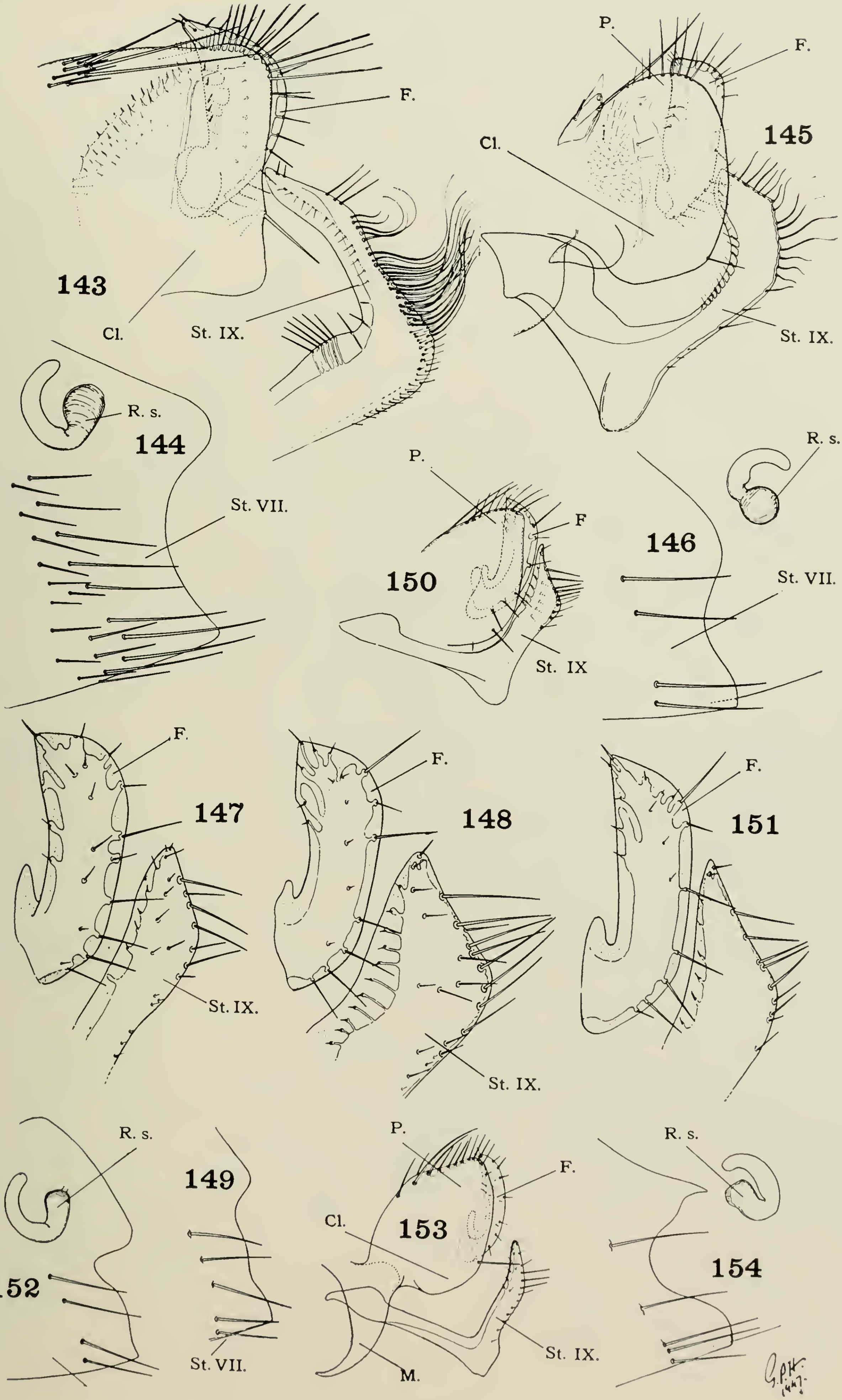
Fig. 150. *Nearctopsylla genalis laurentina* Jordan and Rothschild. Processes of clasper and sternum IX of male (near topotype, Scotch Lake, N.B.).

Fig. 151. *N. genalis laurentina.* Enlarged detail of male genitalia.

Fig. 152. *N. genalis laurentina.* Spermatheca and sternum VII of female (Lincoln, Maine; specimen received from R. Traub).

Fig. 153. *Nearctopsylla jordani* Hubbard. Clasper and sternum IX of male (Huntingdon, B.C.).

Fig. 154. *N. jordani.* Spermatheca and sternum VII of female (Vancouver, B.C.).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St. IX
R. s.
146
St. VII.
F.
147
St. IX.
F.
148
St. IX.
F.
151
R. s.
152
149
St. VII.
P.
F.
Cl.
153
St. IX.
M.
R. s.
154
G.P.H.
1947.

Plate XXI

Family CERATOPHYLLIDAE

Subfamily Amphipsyllinae

Fig. 155. *Amphipsylla sibirica pollionis* (Rothschild). Head and pronotum of female (Chipewyan, Alta.).

Fig. 156. *A. sibirica pollionis.* Clasper of male (after Rothschild).

Fig. 157. *A. sibirica pollionis.* Spermatheca and sternum VII of female (Chipewyan, Alta.).

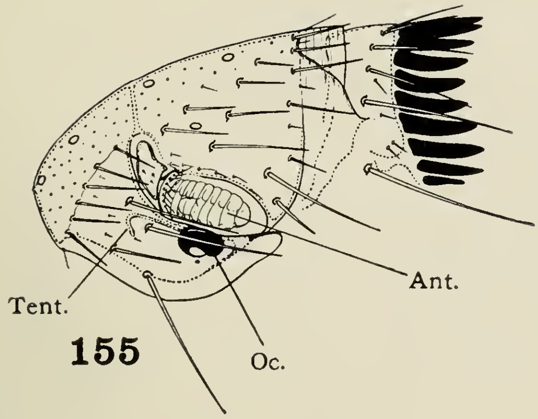
Fig. 158. *Ctenophyllus terribilis* (Rothschild). Head and pronotum of male (Kinbasket Lake, B.C.).

Fig. 159. *C. terribilis.* Genitalia of male.

Fig. 160. *C. terribilis.* Preantennal region of head of female (topotype; Banff, Alta.).

Fig. 161. *C. terribilis.* Spermatheca and sternum VII of female.

Fig. 162. *Odontopsyllus dentatus* (Baker). Head and pronotum of male (Burn, Ore.; specimen received from Wm. L. Jellison).



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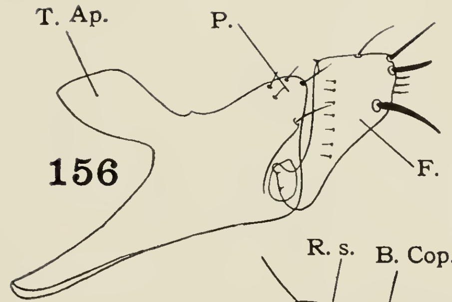

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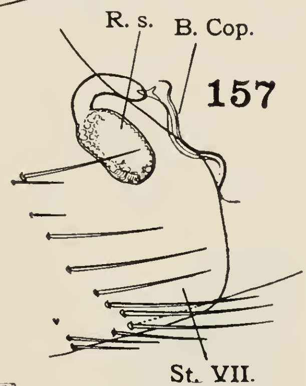

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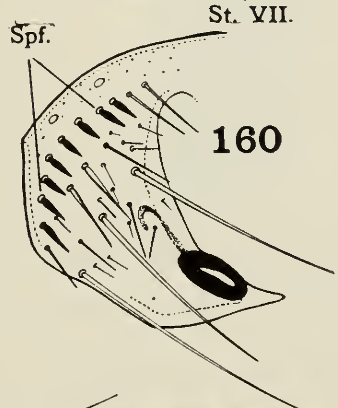

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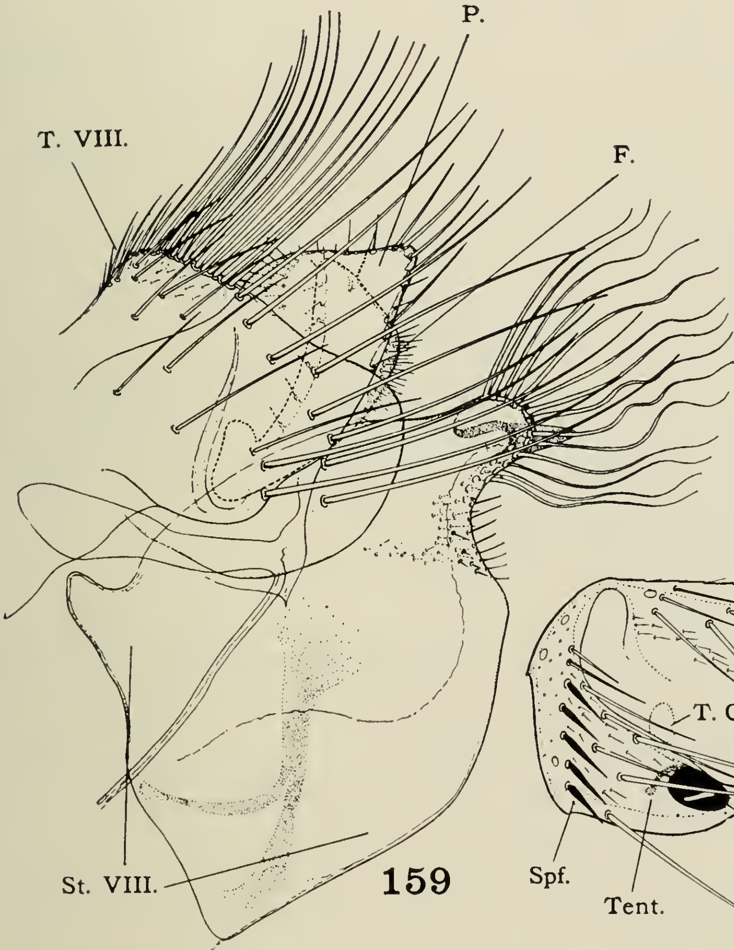

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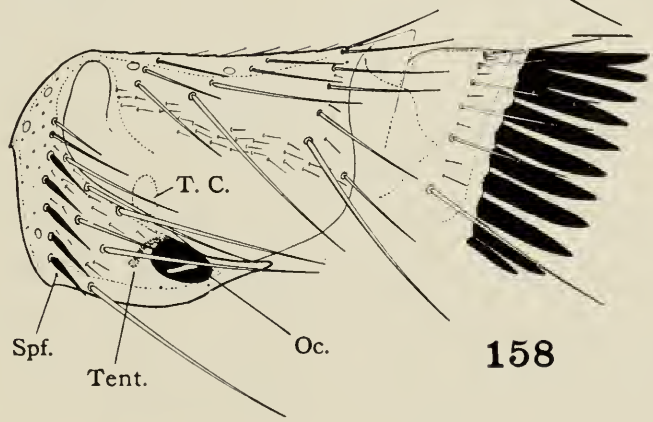

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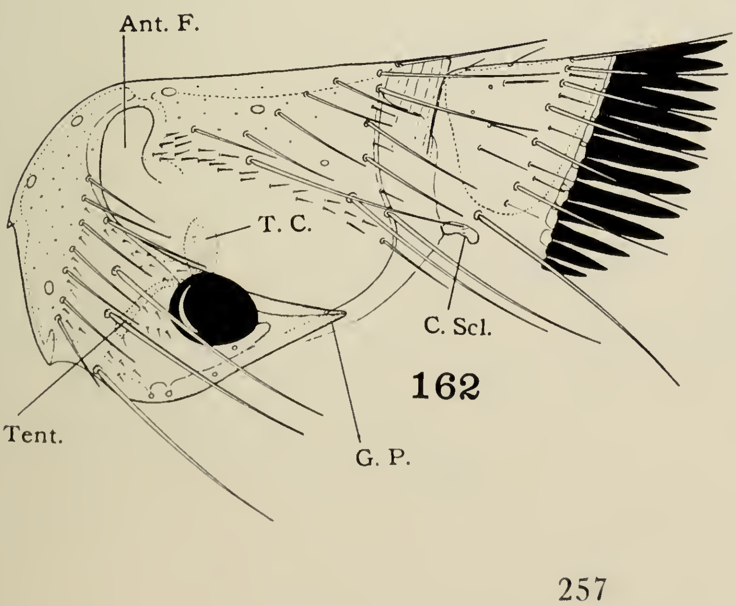

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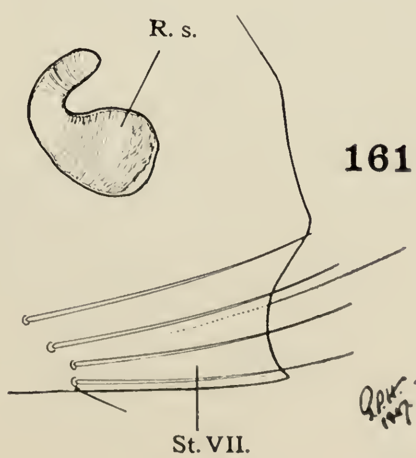

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Plate XXII

Family CERATOPHYLLIDAE

Subfamily Amphipsyllinae

Fig. 163. *Odontopsyllus dentatus* (Baker). Hindcoxa of male (Elkwater, Alta.).

Fig. 164. *O. dentatus.* Clasper of male.

Fig. 165. *O. dentatus.* Spermatheca of female.

Subfamily Dolichopsyllinae

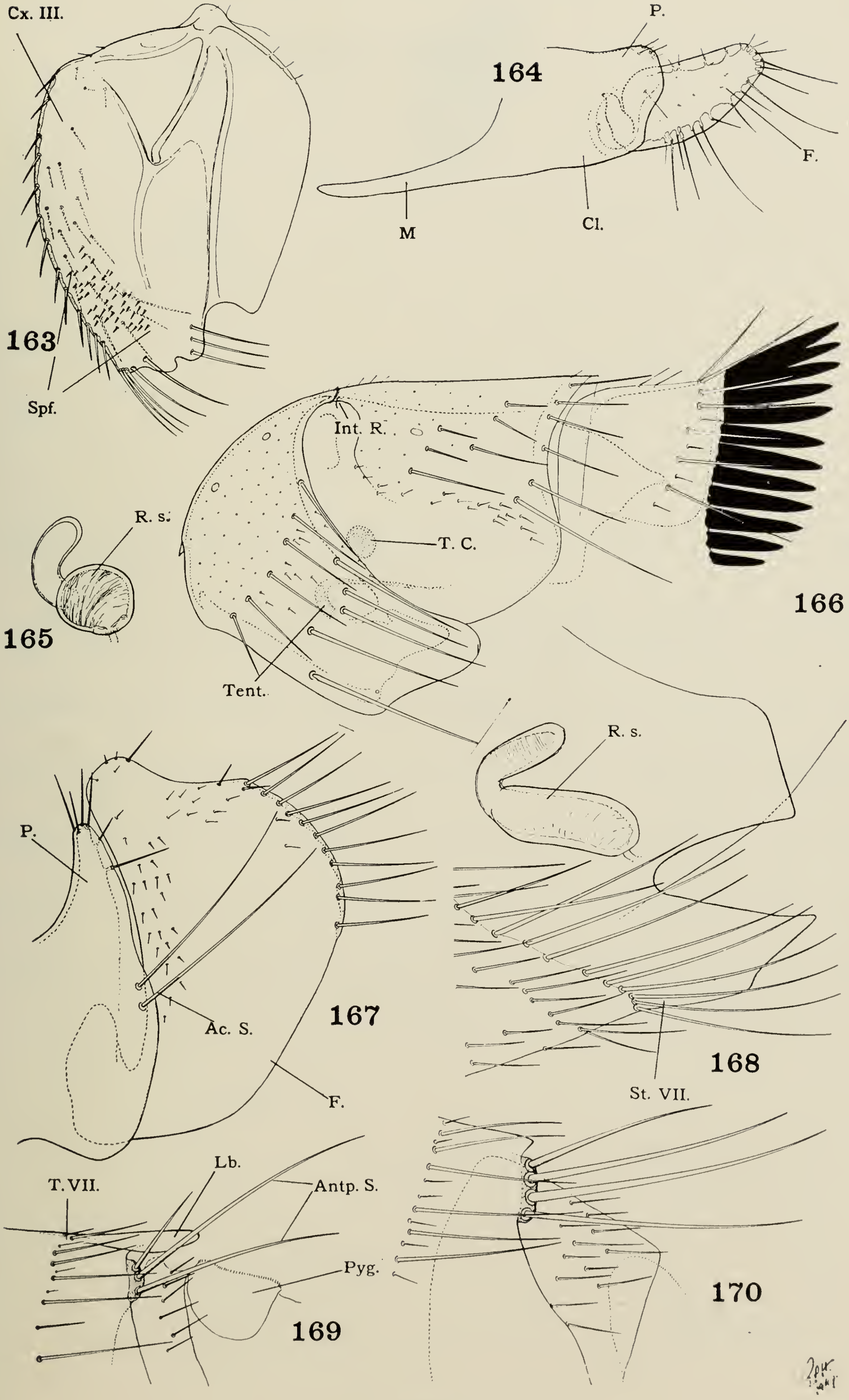
Fig. 166. *Dolichopsyllus stylosus* (Baker). Head and pronotum of male (Huntingdon, B.C.).

Fig. 167. *D. stylosus.* Processes of clasper of male.

Fig. 168. *D. stylosus.* Spermatheca and sternum VII of female.

Fig. 169. *D. stylosus.* Tergum VII and antepygidial setae of male.

Fig. 170. *D. stylosus.* Tergum VII and antepygidial setae of female.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Spf.
164
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M
Cl.
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R. s.
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Int. R.
T. C.
Tent.
167
P.
Ac. S.
F.
168
R. s.
St. VII.
169
T. VII.
Lb.
Antp. S.
Pyg.
170

Plate XXIII

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 171. *Oropsylla arctomys* (Baker). Head and pronotum of male (Quick, B.C.).

Fig. 172. *O. arctomys.* Processes of clasper of male (Kawene, Ont.).

Fig. 173. *O. arctomys.* Spermatheca and sternum VII of female. (Big River, Sask.).

Fig. 174. *Oropsylla alaskensis* (Baker). Processes of clasper of male (Thelon Game Sanctuary, N.W.T.).

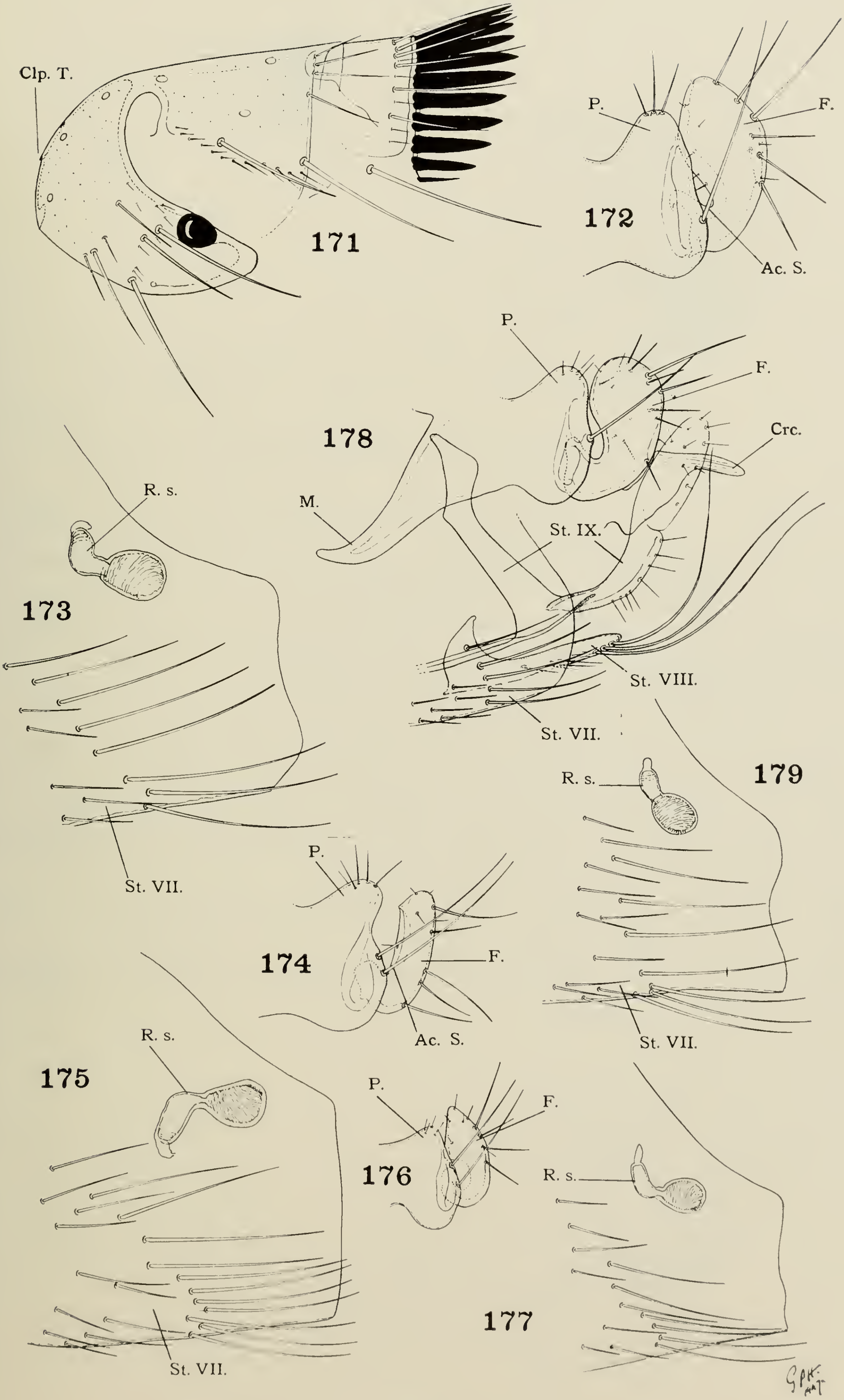
Fig. 175. *O. alaskensis.* Spermatheca and sternum VII of female (Baker Lake, N.W.T.).

Fig. 176. *Oropsylla idahoensis* (Baker). Processes of clasper of male (Jasper National Park, Alta.).

Fig. 177. *O. idahoensis.* Spermatheca and sternum VII of female (Paradise Mine, B.C.).

Fig. 178. *Oropsylla rupestris* (Jordan). Genitalia of male (topotype; Calgary, Alta.).

Fig. 179. *O. rupestris.* Spermatheca and sternum VII of female (topotype).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R. s.
St. VII.
176
P.
F.
177
R. s.
178
P.
F.
Crc.
M.
St. IX.
St. VIII.
St. VII.
179
R. s.
St. VII.

Plate XXIV

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 180. *Thrassis bacchi* (Rothschild). Head and pronotum of male (Estevan, Sask.).

Fig. 181. *Thrassis acamantis* (Rothschild). Genitalia of male (Chase, B.C.).

Fig. 182. *T. acamantis.* Spermatheca and sternum VII of female, showing variation (a-e all from Pritchard, B.C.).

Fig. 183. *Thrassis bacchi* (Rothschild). Clasper of male (Estevan, Sask.).

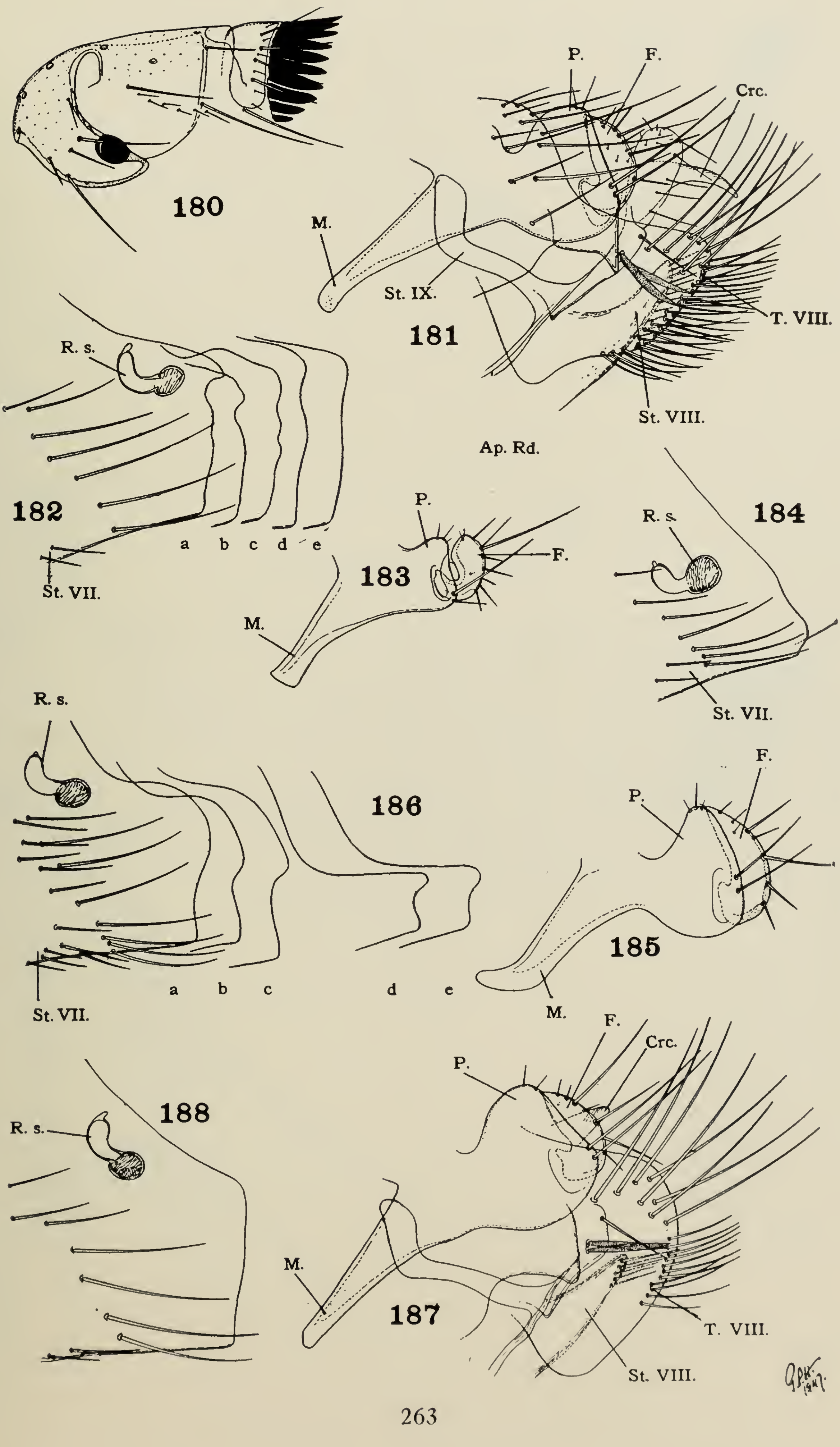
Fig. 184. *T. bacchi.* Spermatheca and sternum VII of female.

Fig. 185. *Thrassis petiolatus* (Baker). Clasper of male (Kelowna, B.C.).

Fig. 186. *T. petiolatus.* Spermatheca and examples of dimorphic sternum VII of female (a-e all from Kelowna, B.C.).

Fig. 187. *Thrassis spenceri* Wagner. Genitalia of male (hototype; Granite Mt., 7000′, Birch Island, B.C.).

Fig. 188. *T. spenceri.* Spermatheca and sternum VII of female (N. Fork of Eagle River, B.C.).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St. VIII.
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Ap. Rd.
P.
F.
183
M.
R. s.
184
St. VII.
R. s.
186
St. VII.
a b c d e
F.
P.
185
M.
188
R. s.
F.
Crc.
P.
M.
187
T. VIII.
St. VIII.
G.P.K. 1947.

Plate XXV

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 189. *Amphalius necopinus* (Jordan). Head and pronotum of female (Brewster Creek, Banff, Alta.).

Fig. 190. *A. necopinus*. Processes of clasper of male (Banff, Alta.).

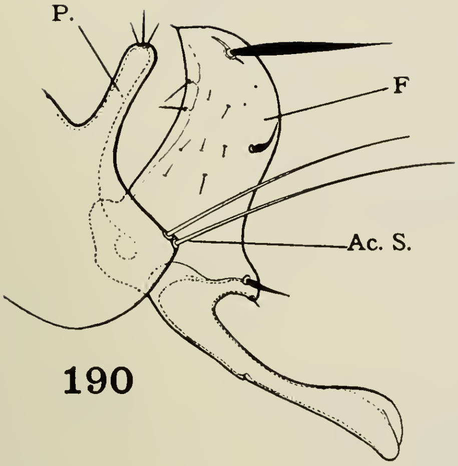
Fig. 191. *A. necopinus*. Spermatheca and sternum VII of female.

Fig. 192. *A. necopinus*. Anal stylet of female.

Fig. 193. *Dactylopsylla comis* Jordan. Head and pronotum of male (Little Lava Lake, Ore.; specimen received from C. A. Hubbard).

Fig. 194. *D. comis*. Hindtibia of male.

Fig. 195. *D. comis*. Processes of clasper of male.



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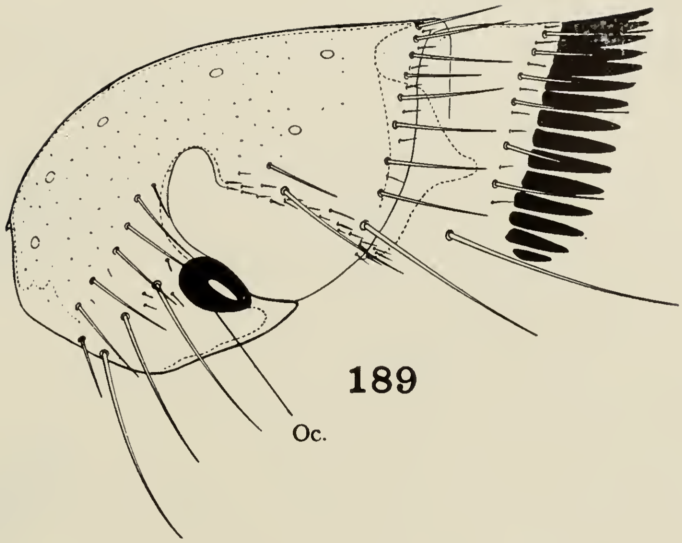

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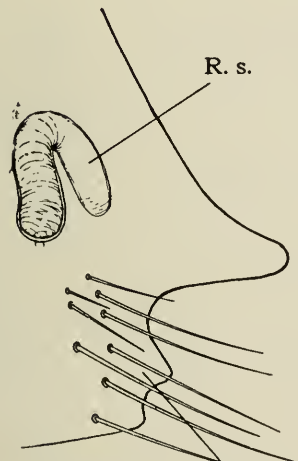

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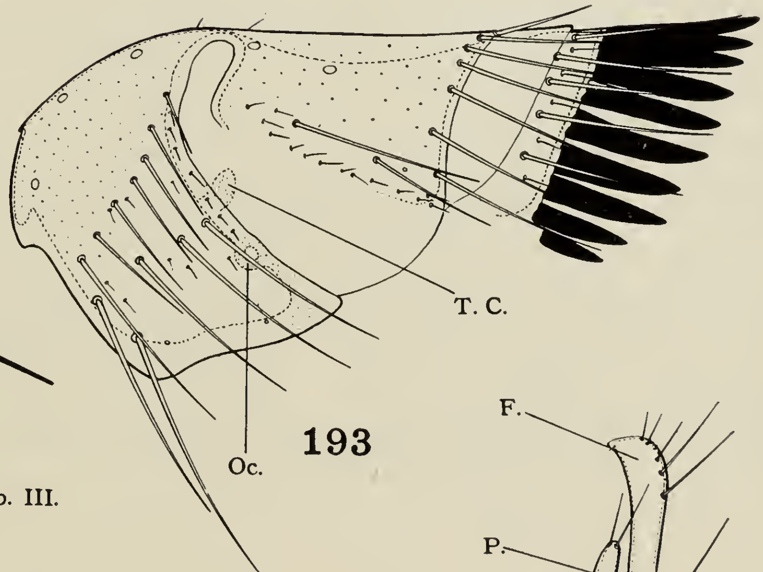

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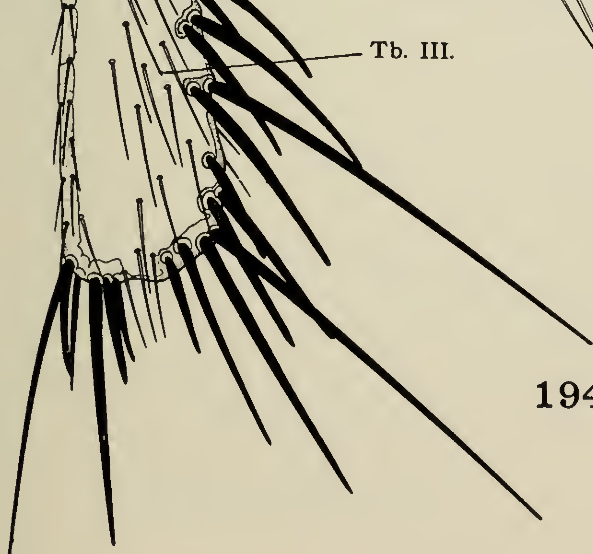

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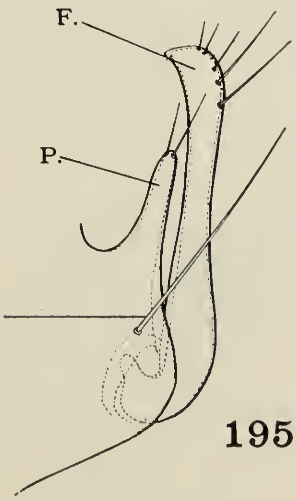

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Plate XXVI

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 196. *Dactylopsylla comis* Jordan. Sternum VIII of male (Little Lava Lake, Ore.).

Fig. 197. *D. comis.* Spermatheca and sternum VII of female (after Jordan).

Fig. 198. *Foxella ignota recula* (Jordan and Rothschild). Head and pronotum of male (topotype; Okanagan Landing, B.C.).

Fig. 199. *F. ignota recula.* Hindtibia of male.

Fig. 200. *F. ignota recula.* Process of clasper and sternum VIII of male.

Fig. 201. *F. ignota recula.* Spermatheca and variations of sternum VII of female (a-e all from Cherry Creek, B.C.).

Fig. 202. *Foxella ignota albertensis* (Jordan and Rothschild). Processes of clasper and sternum VIII of male (Pincher Creek, Alta.).

Fig. 203. *F. ignota albertensis.* Spermatheca and sternum VII of female.

Fig. 204. *Opisocrostis tuberculatus tuberculatus* (Baker). Head and pronotum of male (Saskatoon, Sask.).

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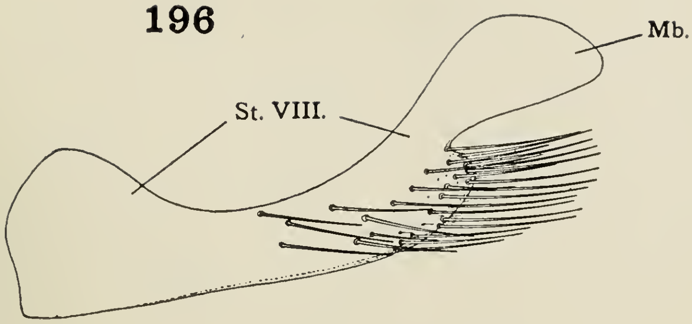

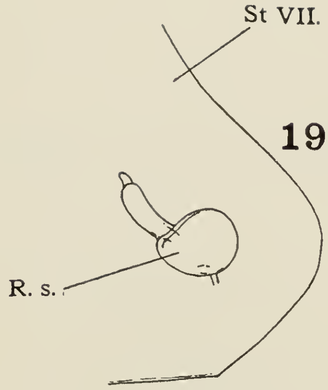

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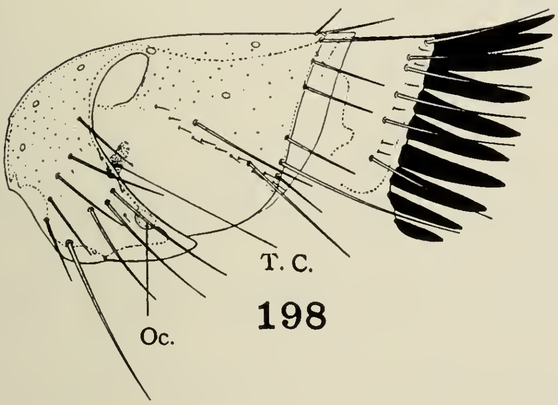

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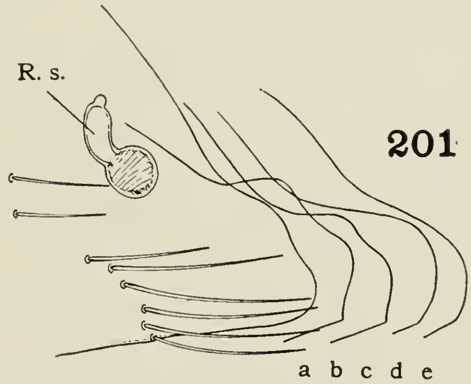

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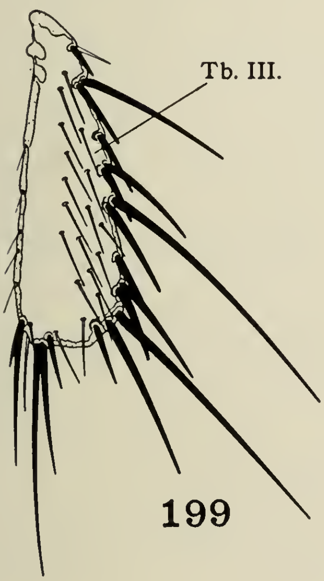

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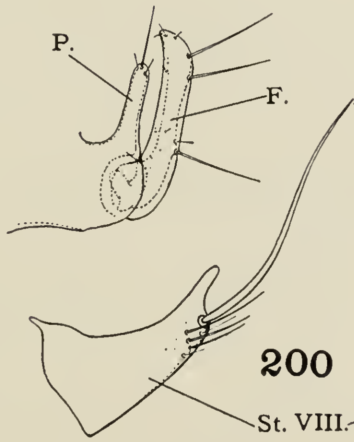

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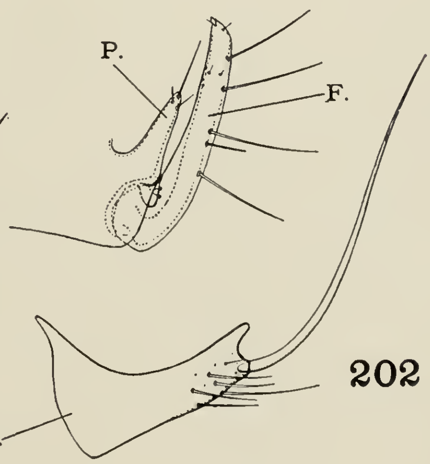

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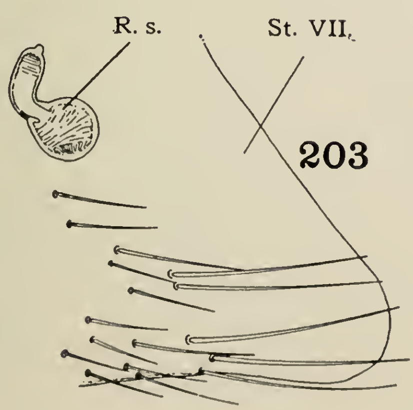

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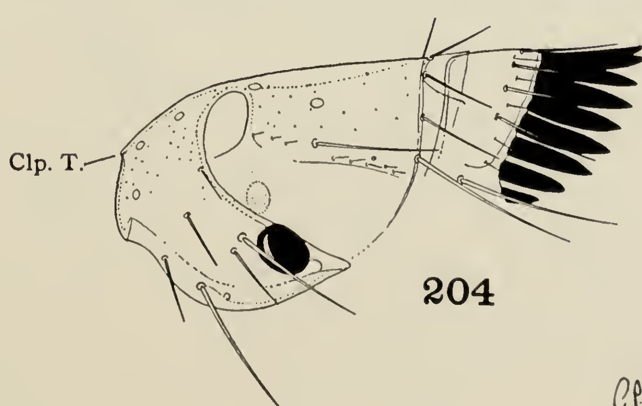

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G.P.H. 1947

Plate XXVII

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 205. *Opisocrostis bruneri* (Baker). Clasper and sternum VIII of male (Carlyle Lake, Sask.).

Fig. 206. *O. bruneri.* Spermatheca and sternum VII of female (Emma Lake, Sask.).

Fig. 207. *Opisocrostis labis* (Jordan and Rothschild). Processes of clasper of male (topotype; Calgary, Alta.).

Fig. 208. *O. labis.* Spermatheca and sternum VII of female (topotype).

Fig. 209. *Opisocrostis saundersi* (Jordan). Clasper of male (after Jordan).

Fig. 210. *O. saundersi.* Spermatheca and sternum VII of female (topotype; Saskatoon, Sask.).

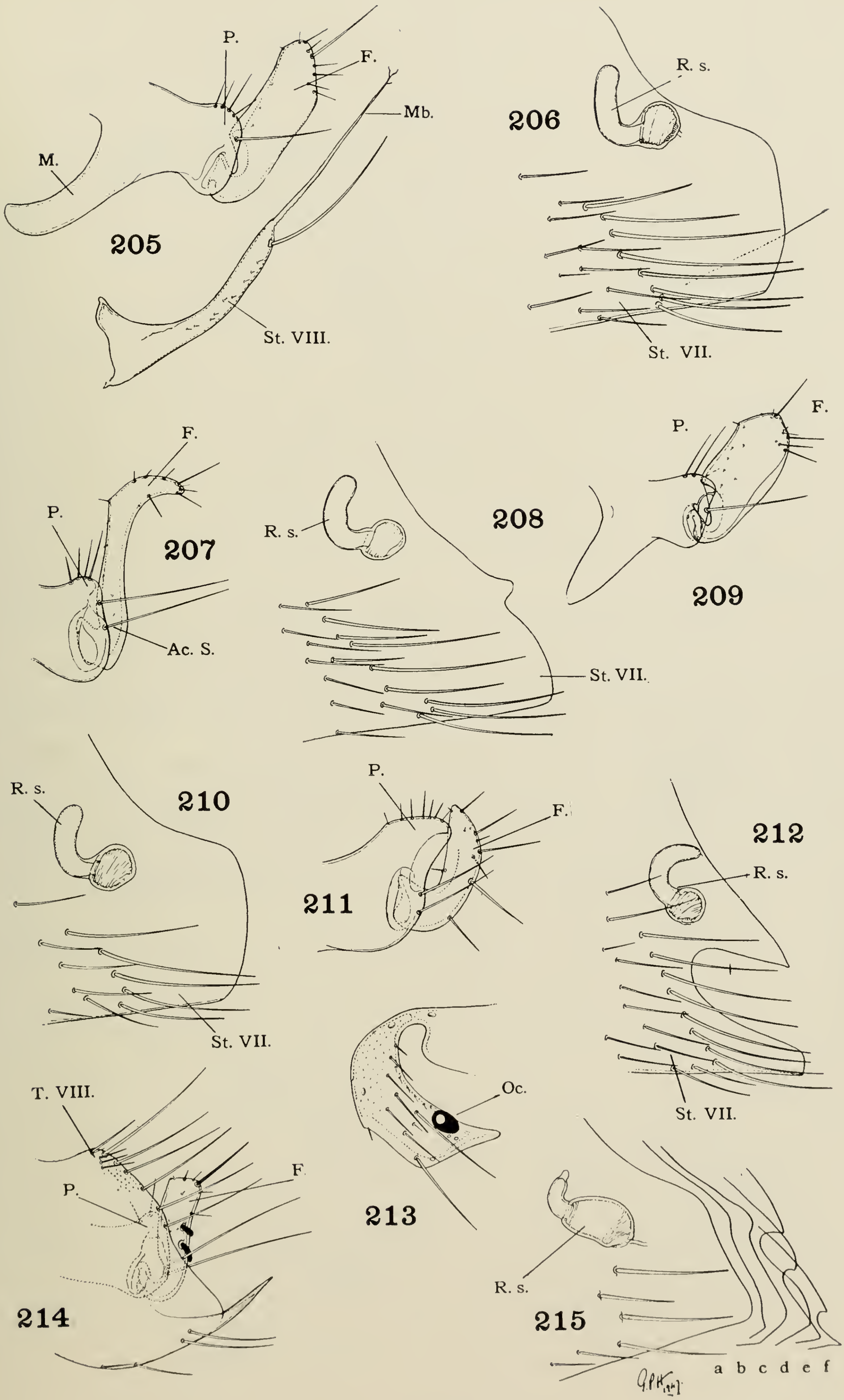
Fig. 211. *Opisocrostis tuberculatus tuberculatus* (Baker). Processes of clasper of male (Saskatoon, Sask.).

Fig. 212. *O. t. tuberculatus.* Spermatheca and sternum VII of female.

Fig. 213. *Opisodasys keeni* (Baker). Preantennal region of head of male (Harrison Bay, B.C.).

Fig. 214. *O. keeni.* Tergum VIII and processes of clasper of male.

Fig. 215. *O. keeni.* Spermatheca and sternum VII of female (topotype, Queen Charlotte Is., B.C.) and (b-f) variations in sternum VII—specimens from various localities in B.C.).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St. VII.
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Ac. S.
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R. s.
St. VII.
209
P.
F.
210
R. s.
St. VII.
211
P.
F.
212
R. s.
St. VII.
213
Oc.
214
T. VIII.
P.
F.
215
R. s.
a b c d e f

Plate XXVIII

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 216. *Opisodasys pseudarctomys* (Baker). Processes of clasper and abdominal segment VIII of male (Blackpool, B.C.).

Fig. 217. *O. pseudarctomys.* Spermatheca and sternum VII of female.

Fig. 218. *Opisodasys vesperalis* (Jordan). Processes of clasper of male (Lac la Hache, B.C.).

Fig. 219. *O. vesperalis.* Anal segments of female (Tenquille Lake, B.C.).

Fig. 220. *O. vesperalis.* Spermatheca and variation in sternum VII of female (a-g, all from Tenquille Lake, B.C.).

Fig. 221. *Orchopeas caedens caedens* (Jordan). Genitalia of male (Fort Liard, N.W.T.).

Fig. 222. *O. caedens caedens.* Spermatheca, sternum VII and anal segments of female.

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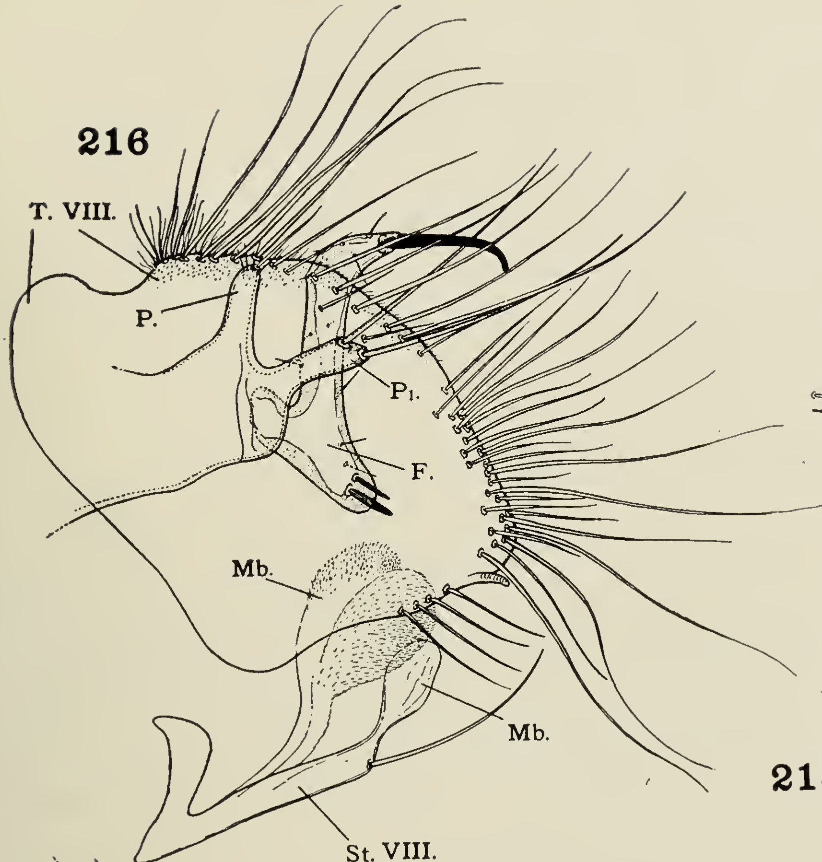

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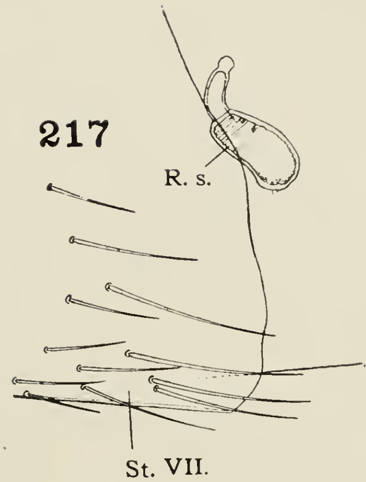

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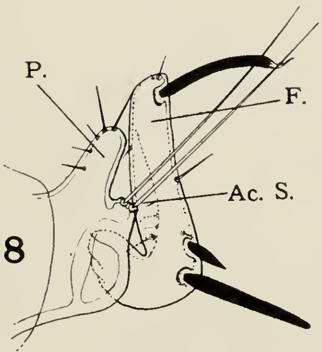

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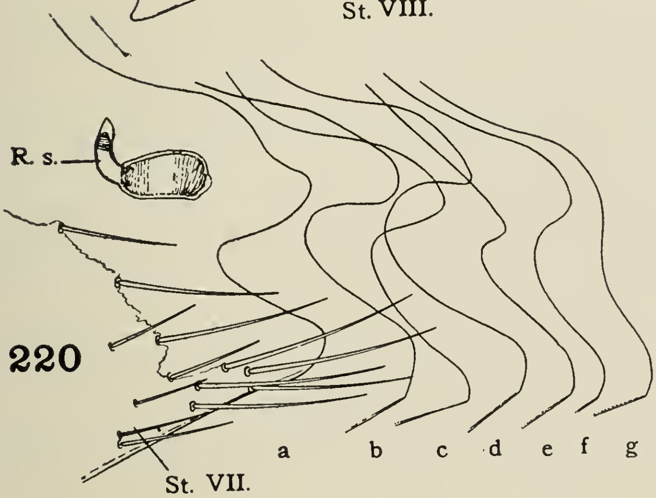

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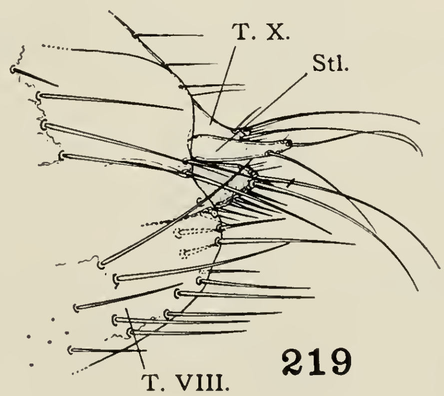

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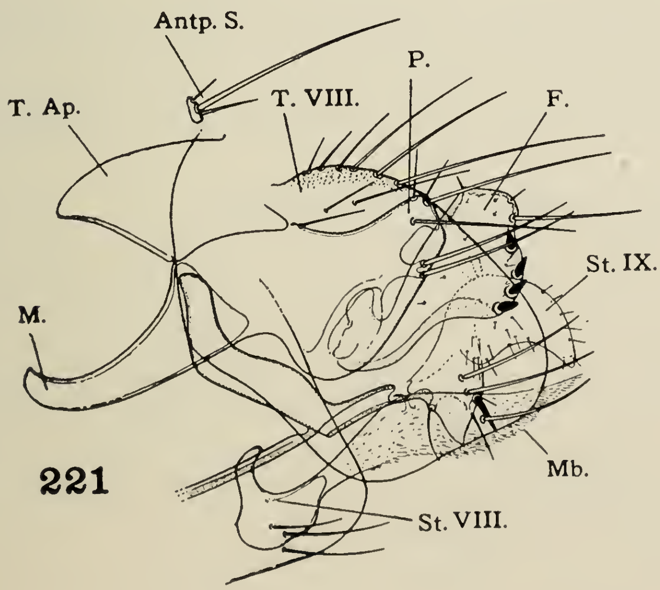

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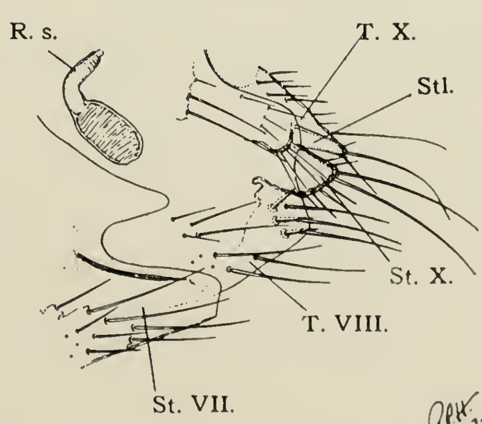


Plate XXIX

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 223. *Orchopeas caedens caedens* (Jordan). Variation in sternum VII of female (a-h, all from Fort Liard, N.W.T.).

Fig. 224. *Orchopeas caedens durus* (Jordan). Spermatheca and variation in sternum VII of female (a-i, all from Quesnel, B.C.).

Fig. 225. *Orchopeas caedens caedens* (Jordan). Preantennal region of head of male (Blackfalds, Alta.).

Fig. 226. *Orchopeas sexdentatus agilis* (Rothschild). Preantennal region of head of male (Tappen, B.C.).

Fig. 227. *Orchopeas leucopus* (Baker). Processes of clasper of male (Blackfalds, Alta.).

Fig. 228. *O. leucopus.* Spermatheca and sternum VII of female (Kawene, Ont.).

Fig. 229. *Orchopeas nepos* (Rothschild). Processes of clasper of male (Chilliwack, B.C.).

Fig. 230. *O. nepos.* Spermatheca and variations in sternum VII of female (a-d, from Vancouver and other localities in coastal B.C.).

Fig. 231. *Orchopeas sexdentatus agilis* (Rothschild). Processes of clasper of male (Tappen, B.C.).

Fig. 232. *O. sexdentatus agilis.* Spermatheca and variation in sternum VII of female (a-g, all from Kinbasket Lake, B.C.).

Fig. 233. *Orchopeas howardii* (Baker). Processes of clasper of male (Chatham, Ont.).

Fig. 234. *O. howardii.* Spermatheca and sternum VII of female.

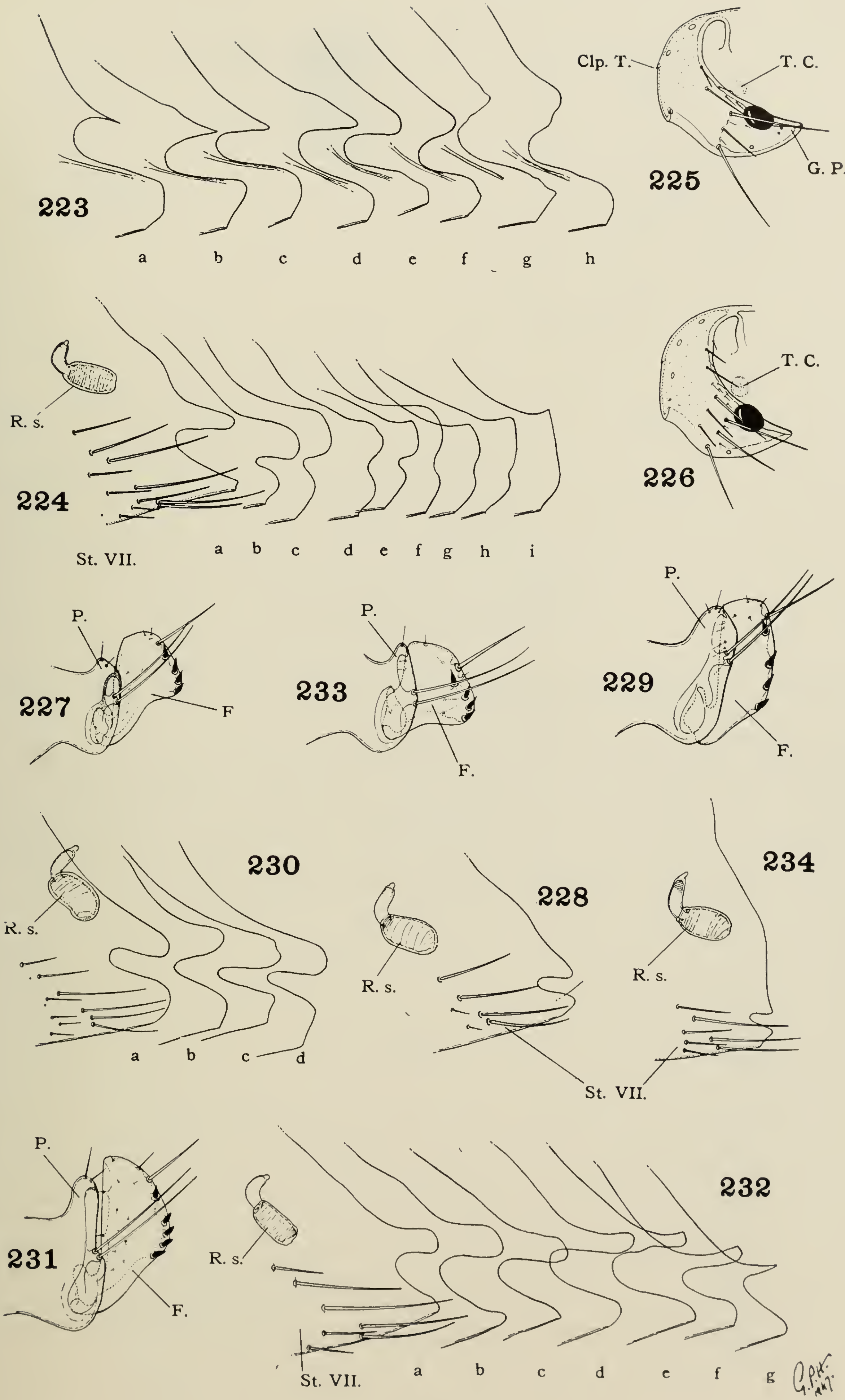

223
a b c d e f g h
Clp. T.
T. C.
G. P.
225
R. s.
224
St. VII.
a b c d e f g h i
T. C.
226
P.
227
F
P.
233
F.
P.
229
F.
R. s.
230
a b c d
R. s.
228
St. VII.
R. s.
234
P.
231
F.
R. s.
232
St. VII.
a b c d e f g

Plate XXX

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

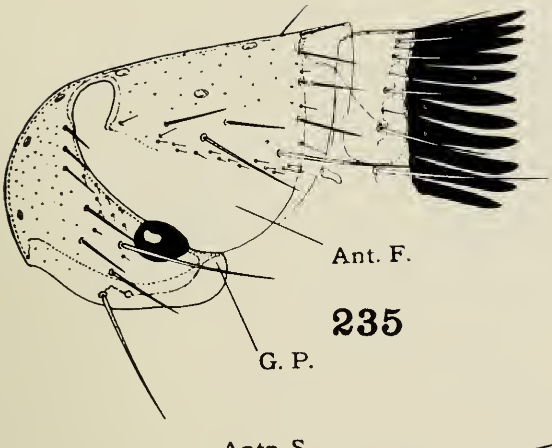
Fig. 235. *Tarsopsylla coloradensis* (Baker). Head and pronotum of male (Paradise Mine, B.C.).

Fig. 236. *T. coloradensis.* Genitalia of male (Lac la Hache, B.C.).

Fig. 237. *T. coloradensis.* Enlarged detail of moveable process of clasper.

Fig. 238. *T. coloradensis.* Tarsus of hind leg of male (Paradise Mine, B.C.).

Fig. 239. *T. coloradensis.* Spermatheca and sternum VII of female showing variation (a-e, from various localities in B.C.).



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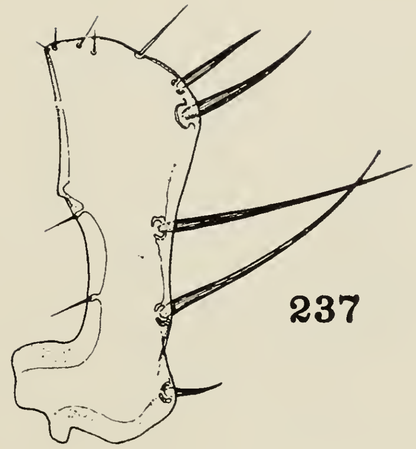

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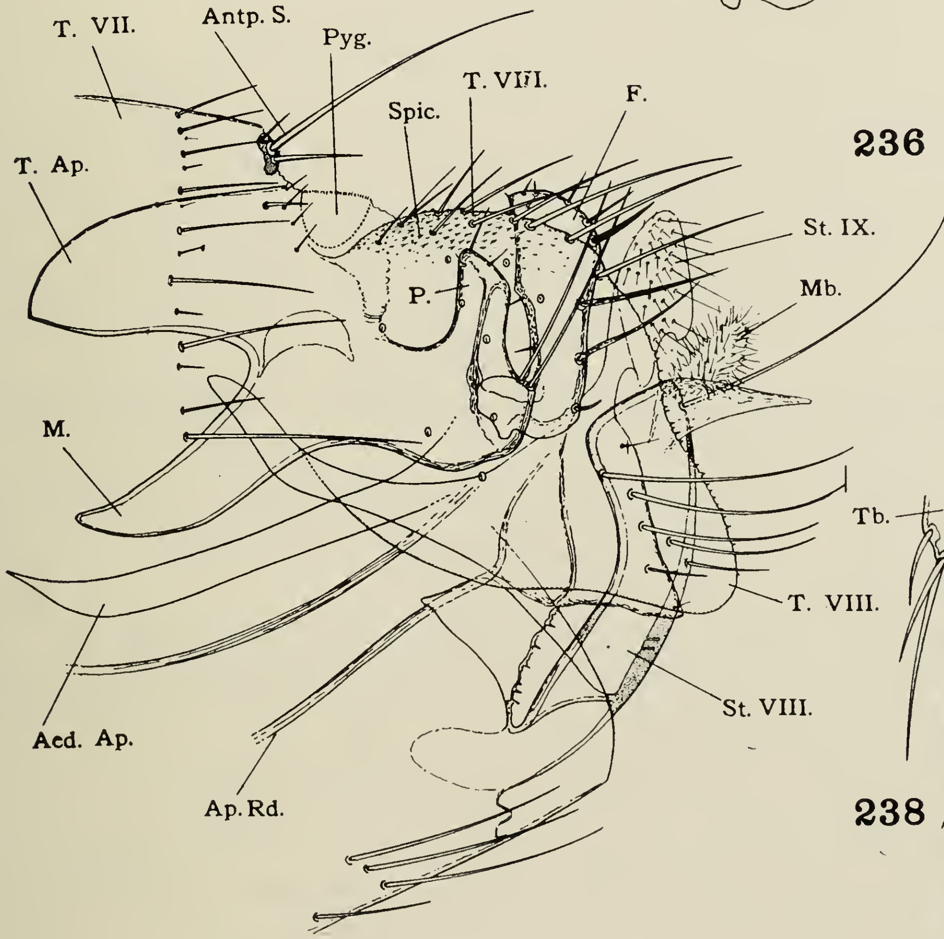

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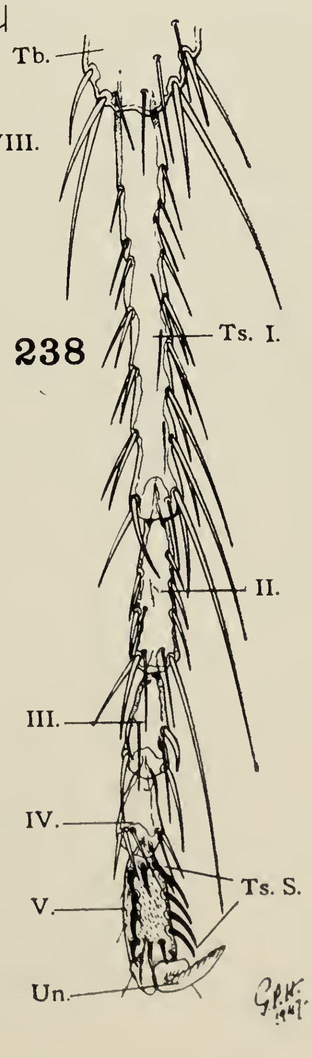

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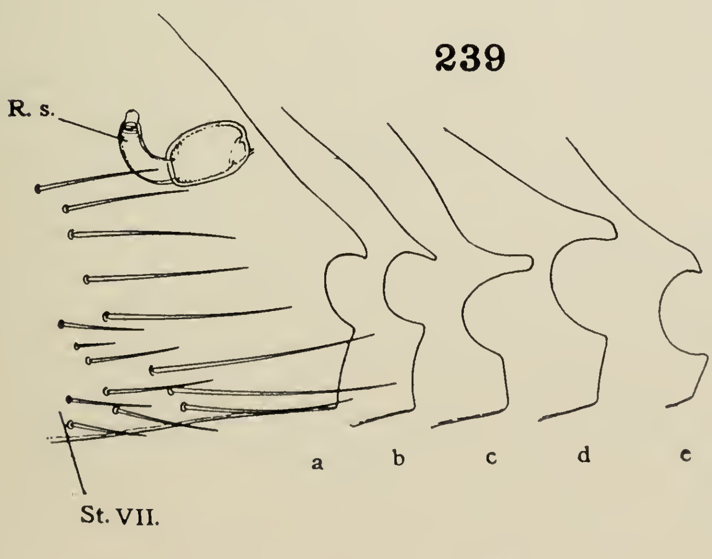

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Plate XXXI

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 240. *Ceratophyllus riparius* Jordan and Rothschild. Head and pronotum of male (Kamloops, B.C.).

Fig. 241. *Ceratophyllus adustus* Jordan. Hintibia of female (after Jordan).

Fig. 242. *C. adustus.* Spermatheca and abdominal segments VII and VIII (after Jordan).

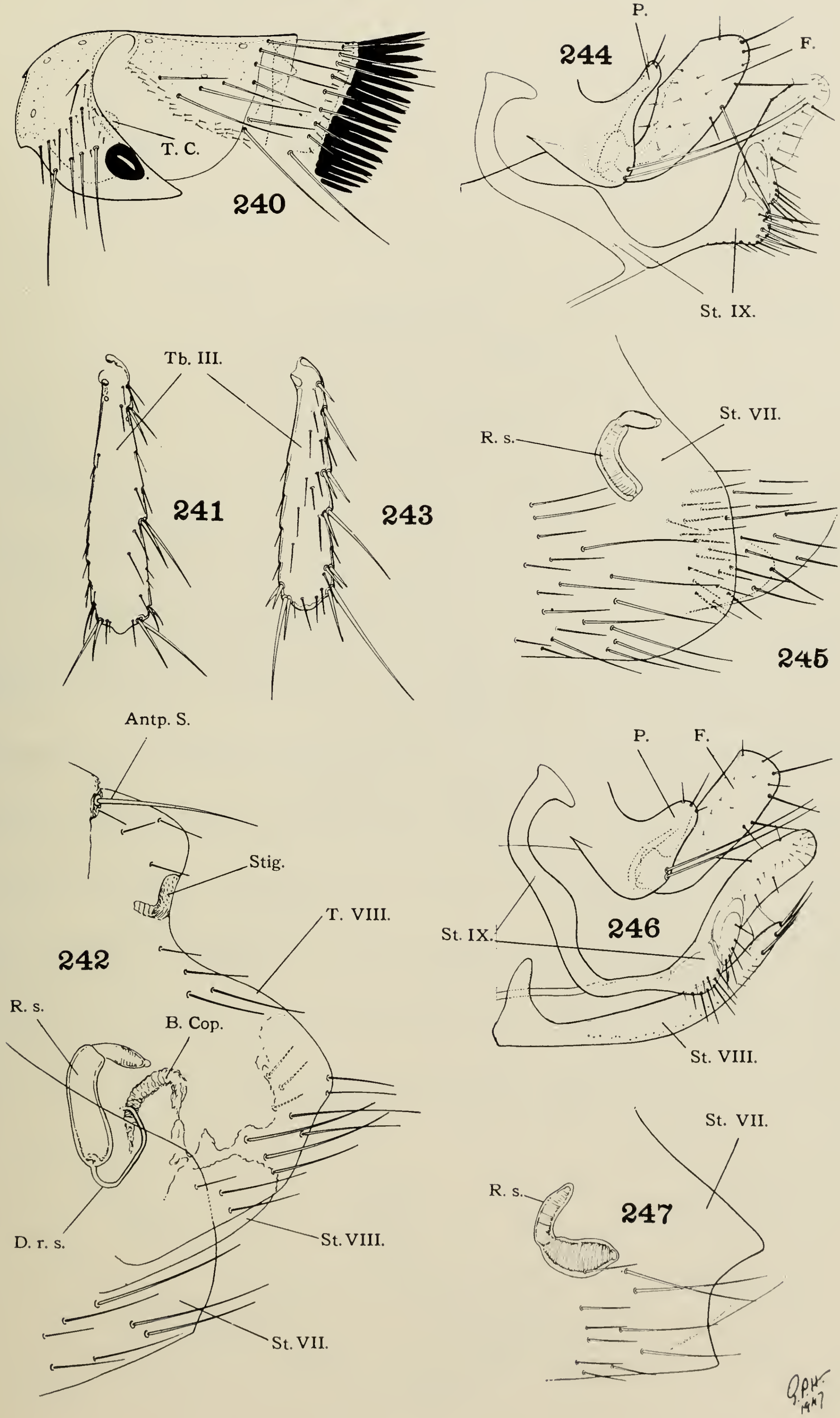
Fig. 243. *Ceratophyllus niger* C. Fox. Hintibia of male (Tatla Lake, B.C.).

Fig. 244. *Ceratophyllus celsus celsus* Jordan. Processes of clasper and sternum IX of male (Kamloops, B.C.).

Fig. 245. *C. celsus celsus.* Spermatheca and sternum VII of female.

Fig. 246. *Ceratophyllus diffinis* Jordan. Genitalia of male (Vavenby, B.C.):

Fig. 247. *C. diffinis.* Spermatheca and sternum VII of female (Vernon, B.C.).


240
T. C.
244
P.
F.
St. IX.
Tb. III.
241
243
R. s.
St. VII.
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Antp. S.
Stig.
T. VIII.
242
R. s.
B. Cop.
D. r. s.
St. VIII.
St. VII.
P.
F.
246
St. IX.
St. VIII.
247
R. s.
St. VII.
G.P.H.
1947

Plate XXXII

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 248. *Ceratophyllus gallinae* (Schrank). Processes of clasper of male.

Fig. 249. *C. gallinae.* Spermatheca and sternum VII of female.

Fig. 250. *Ceratophyllus garei* Rothschild. Processes of clasper and sternum VIII of male (Chipewyan, Alta.).

Fig. 251. *C. garei.* Spermatheca and sternum VII of female.

Fig. 252. *Ceratophyllus idius* Jordan and Rothschild. Processes of clasper and portions of tergum VIII and sternum IX of male (Rock, Mass.; specimen received from Irving Fox).

Fig. 253. *C. idius.* Spermatheca and sternum VII of female (Clarksville, Ill.; specimen received from Irving Fox).

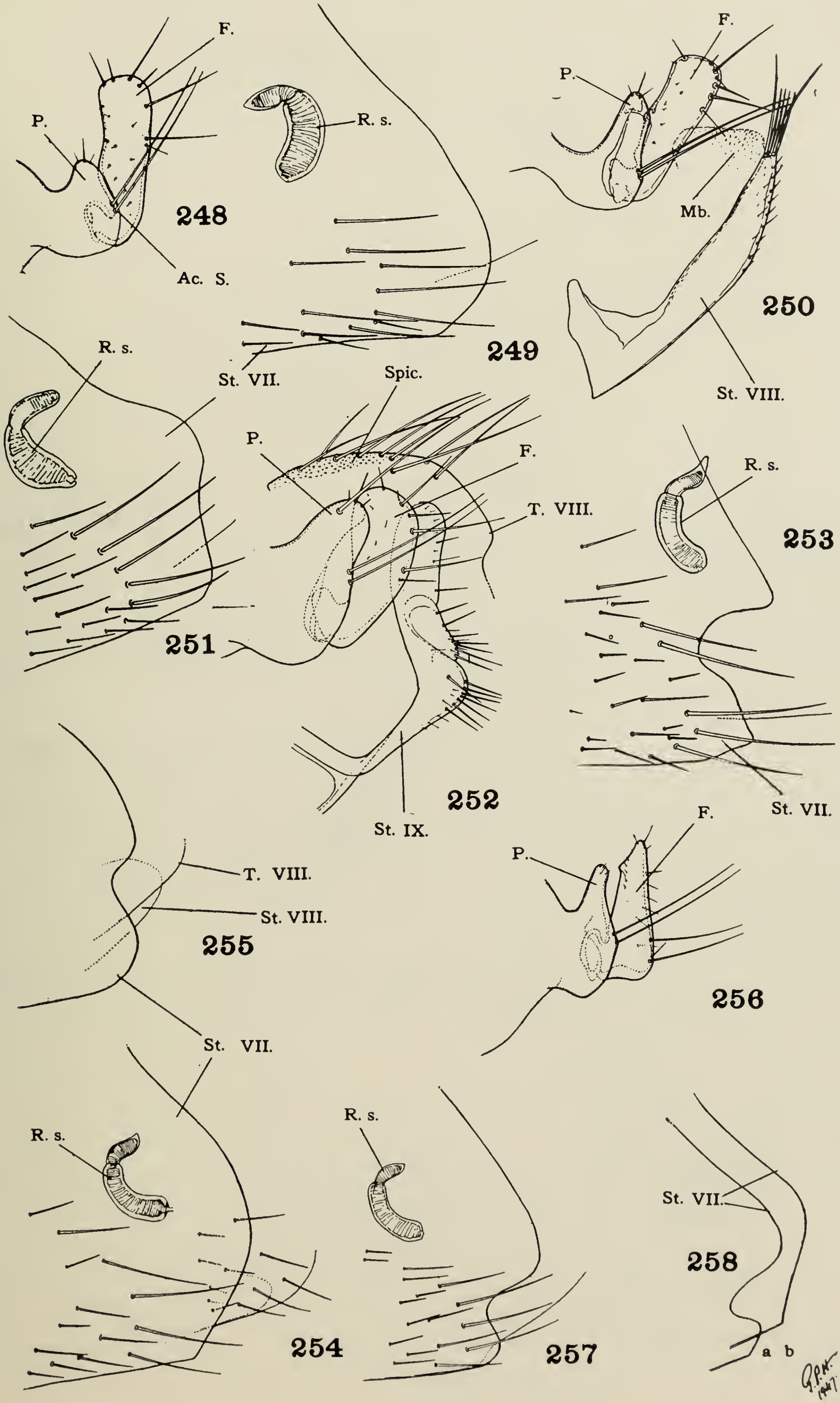
Fig. 254. *Ceratophyllus niger* C. Fox. Spermatheca and sternum VII of female (Ballingall Island, B.C.).

Fig. 255. *C. niger.* Variation of sternum VII (Jordan's "*C. niger inflexus*", Lulu Is., B.C.).

Fig. 256. *Ceratophyllus petrochelidoni* Wagner. Processes of clasper of male (holotype; Chilcotin, B.C.).

Fig. 257. *C. petrochelidoni.* Spermatheca and sternum VII of female (allotype; Chilcotin, B.C.).

Fig. 258. *C. petrochelidoni.* a-b, dimorphic sternum VII of female (Calaveras Dam, Cal.; specimens from P. Quentin Tomich).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Mb.
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R. s.
St. VII.
Spic.
P.
F.
T. VIII.
251
252
St. IX.
R. s.
253
St. VII.
T. VIII.
St. VIII.
255
St. VII.
P.
F.
256
R. s.
R. s.
254
257
St. VII.
258
a b
G.P.H.
1947

Plate XXXIII

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 259. *Ceratophyllus riparius* Jordan and Rothschild. Processes of clasper and sternum IX of male (Kamloops, B.C.).

Fig. 260. *C. riparius.* Spermatheca and sternum VII of female.

Fig. 261. *Ceratophyllus tundrensis* Holland. Processes of clasper and dorsal part of tergum VIII of male (paratype; Baker Lake, N.W.T.).

Fig. 262. *C. tundrensis.* Spermatheca and sternum VII of female (after Holland).

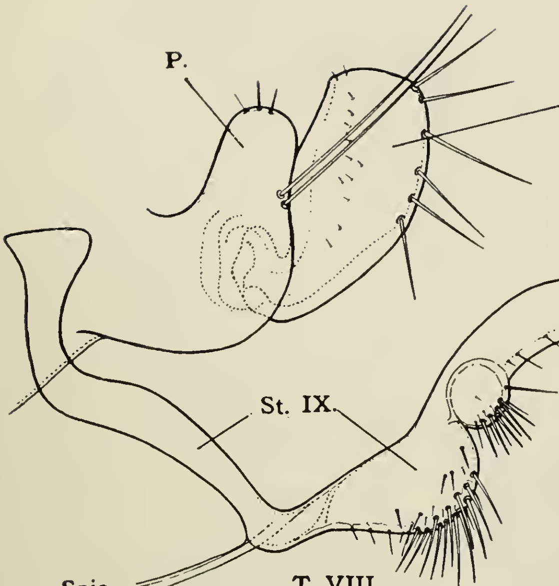
Fig. 263. *Dasypsyllus gallinulae perpinnatus* (Baker). Head and pronotum of male (Huntingdon, B.C.).

Fig. 264. *D. gallinulae perpinnatus.* Hindtarsal segment V of male.

Fig. 265. *D. gallinulae perpinnatus.* Processes of clasper of male.

Fig. 266. *D. gallinulae perpinnatus.* Spermatheca and sternum VII of female (Vancouver, B.C.).

Fig. 267. *Malaraeus bitterrootensis* (Dunn). Clasper, dorsal arm of sternum IX and sternum VIII of male (Ravalli Co., Mont.; specimen received from Wm. L. Jellison).



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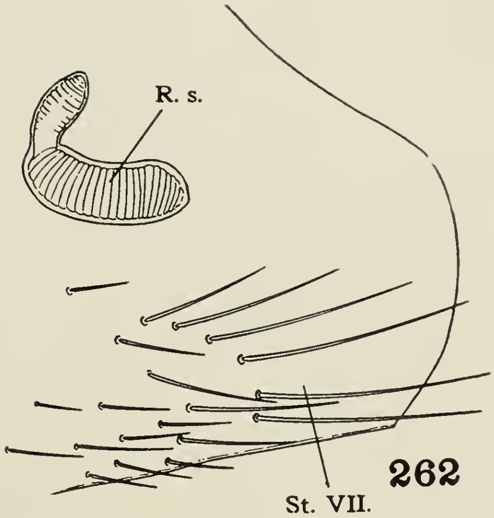

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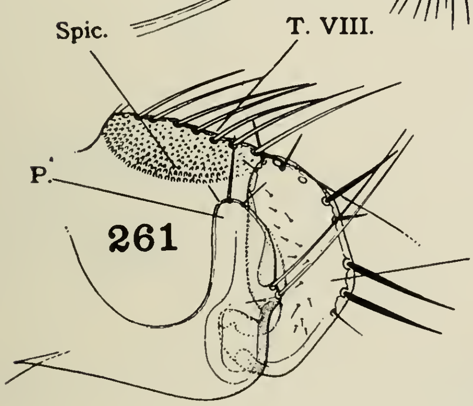

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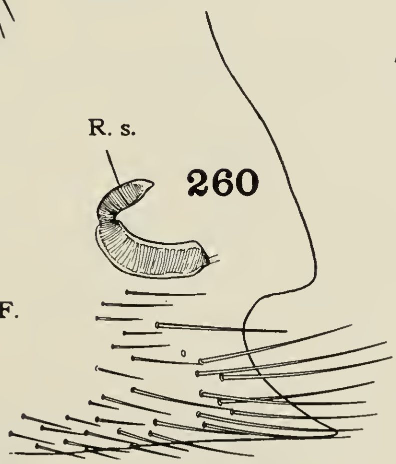

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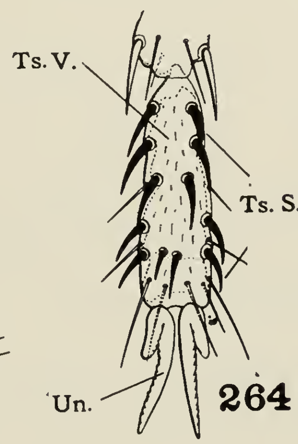

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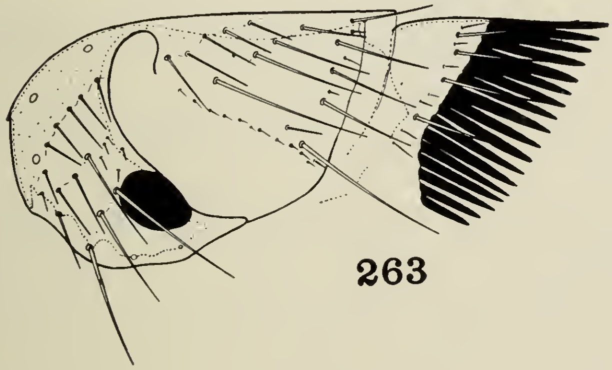
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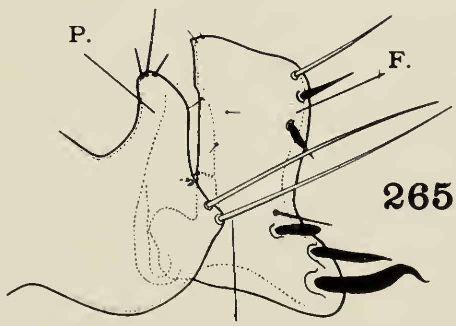

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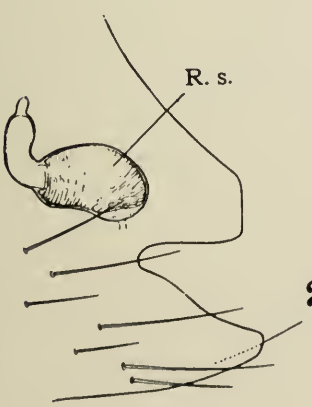

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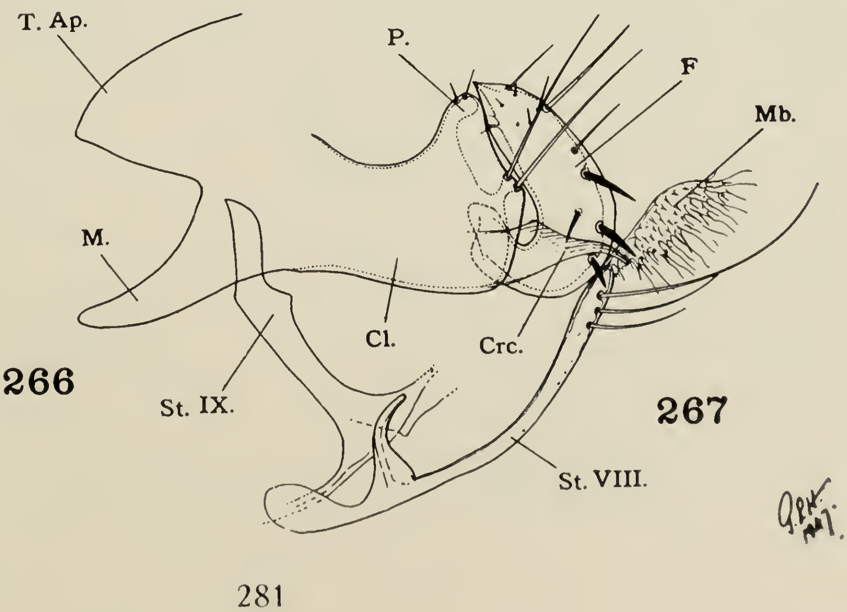

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Plate XXXIV

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 268. *Malaraeus bitterrootensis* (Dunn). Spermatheca and sternum VII of female (Ravalli Co., Mont.; specimen received from Wm. L. Jellison).

Fig. 269. *Malaraeus euphorbi* (Rothschild). Genitalia of male (Kamloops, B.C.).

Fig. 270. *M. euphorbi*. Spermatheca and sternum VII of female.

Fig. 271. *Malaraeus telchinum* (Rothschild). Processes of clasper of male (Kinbasket Lake, B.C.).

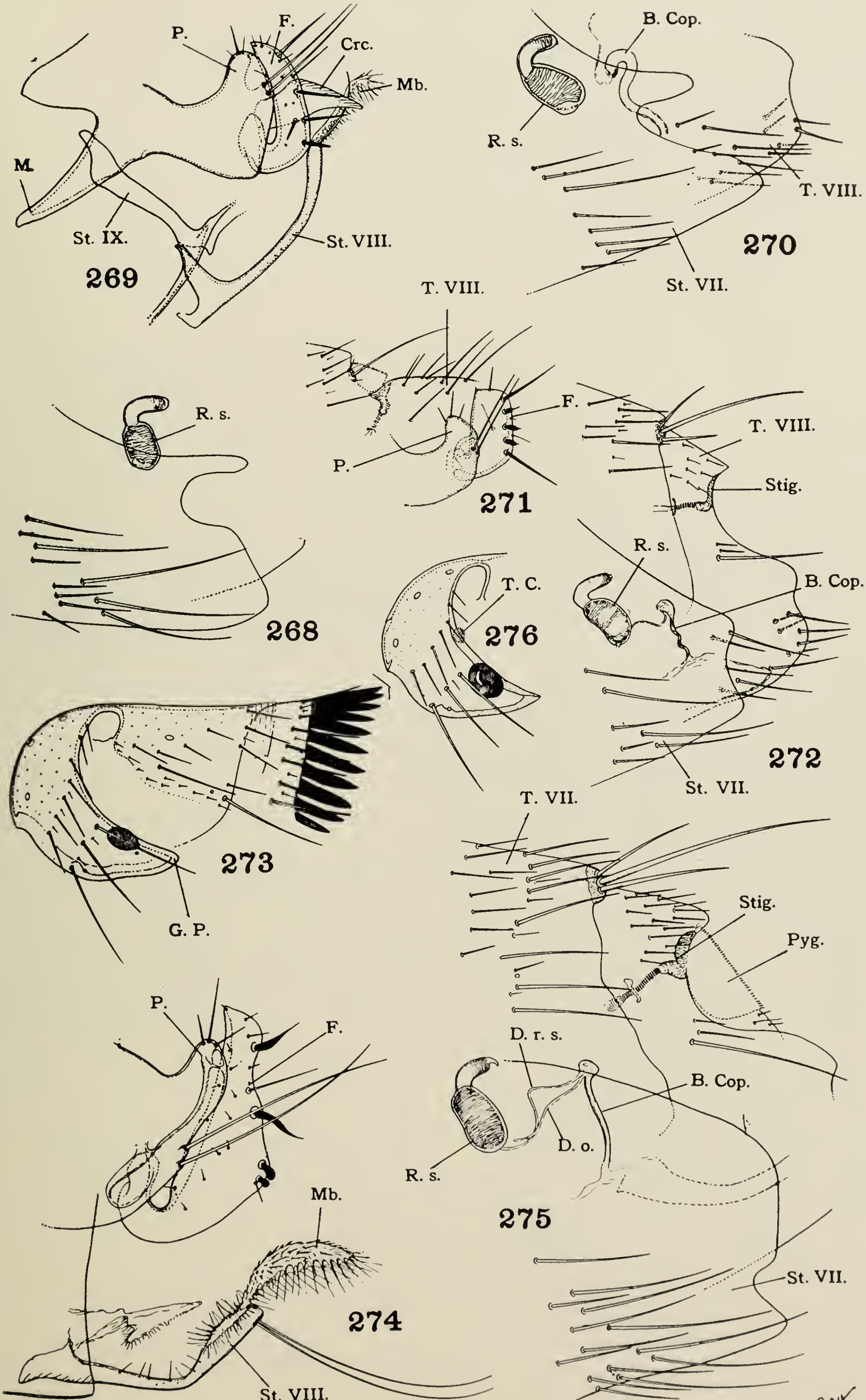
Fig. 272. *M. telchinum*. Spermatheca and abdominal segments VII and VIII of female.

Fig. 273. *Malaraeus penicilliger dissimilis* Jordan. Head and pronotum of male (Chipewyan, Alta.).

Fig. 274. *M. penicilliger dissimilis*. Processes of clasper and sternum VIII of male (paratype; Rapids, Alaska; specimen loaned by Wm . L. Jellison).

Fig. 275. *M. penicilliger dissimilis*. Spermatheca and abdominal segments VII and VIII of female (Maligne Lake, Jasper National Park, Alta.).

Fig. 276. *Megabothris quirini* (Rothschild). Preantennal region of head of male (Elkwater, Alta.).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T. VIII.
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T. VIII.
F.
P.
271
R. s.
268
T. VIII.
Stig.
R. s.
B. Cop.
272
St. VII.
T. C.
276
273
G. P.
T. VII.
Stig.
Pyg.
D. r. s.
B. Cop.
D. o.
R. s.
275
St. VII.
P.
F.
Mb.
274
St. VIII.
G.P.H. 1947

Plate XXXV

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 277. *Malaraeus penicilliger dissimilis* Jordan. Variation in sternum VII of female (a, Reliance, N.W.T.; b, Arctic Red River, N.W.T.; c, d, Tenquille Lake, B.C.; e, Chipewyan, Alta.; f, g, Maligne Lake, Alta.; h, Arctic Red River; i, j, Reliance; k, Tenquille Lake; l, m, left and right sides of allotype, Rapids, Alaska, loaned by Wm. L. Jellison).

Fig. 278. *Megabothris abantis* (Rothschild). Parts of terga VII and VIII and process of clasper of male (Peters Lake, B.C.).

Fig. 279. *M. abantis.* Spermatheca and abdominal segments VII and VIII of female (topotype; Banff, Alta.).

Fig. 280. *Megabothris acerbus* (Jordan). Stigma VIII and processes of clasper of male (Brule Lake, Ont.).

Fig. 281. *M. acerbus.* Spermatheca and abdominal segments VII and VIII of female (Kapuscasing, Ont.).

Fig. 282. *Megabothris asio megacolpus* (Jordan). Stigma VIII and processes of clasper of male (topotype; Okanagan Landing, B.C.).

Fig. 283. *M. asio megacolpus.* Spermatheca and abdominal segments VII and VIII of female (topotype).

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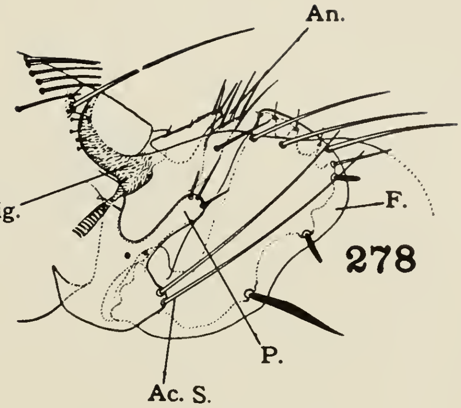

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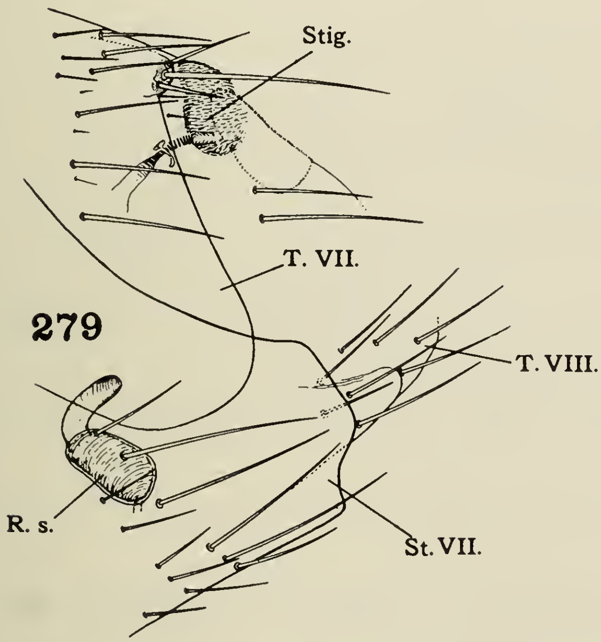

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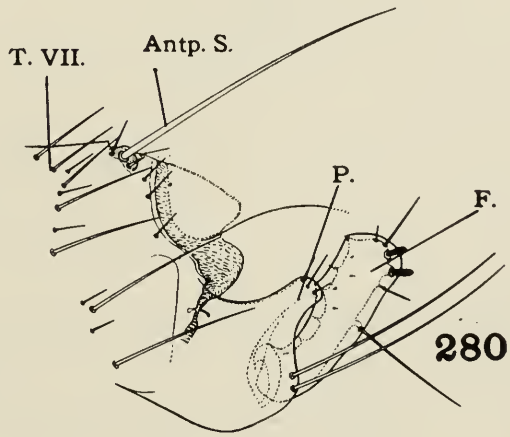

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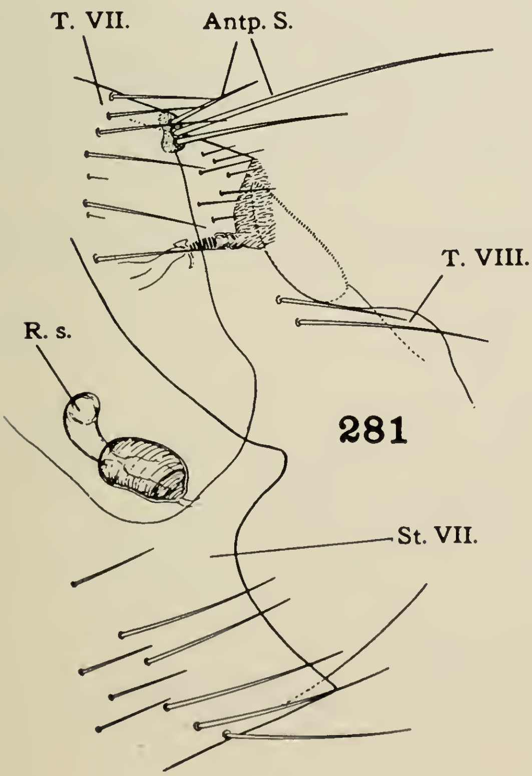

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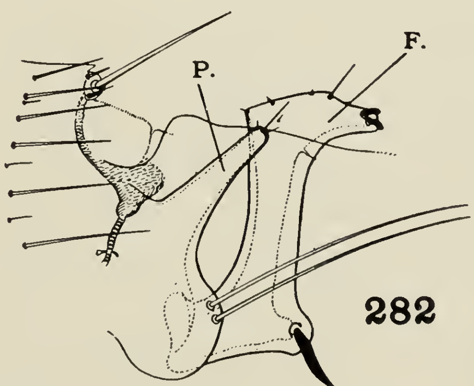

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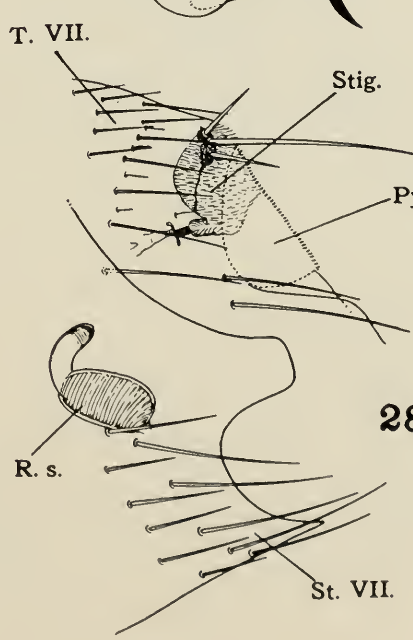

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Plate XXXVI

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 284. *Megabothris asio megacolpus* (Jordan). Variation in sternum VII of female (a-k, all from Williams Lake, B.C.).

Fig. 285. *Megabothris atrox* (Jordan). Stigma VIII and processes of clasper of male (paratype; Blackfalds, Alta. Specimen received from K. Jordan).

Fig. 286. *M. atrox.* Spermatheca and sternum VII of female (paratype, received from K. Jordan).

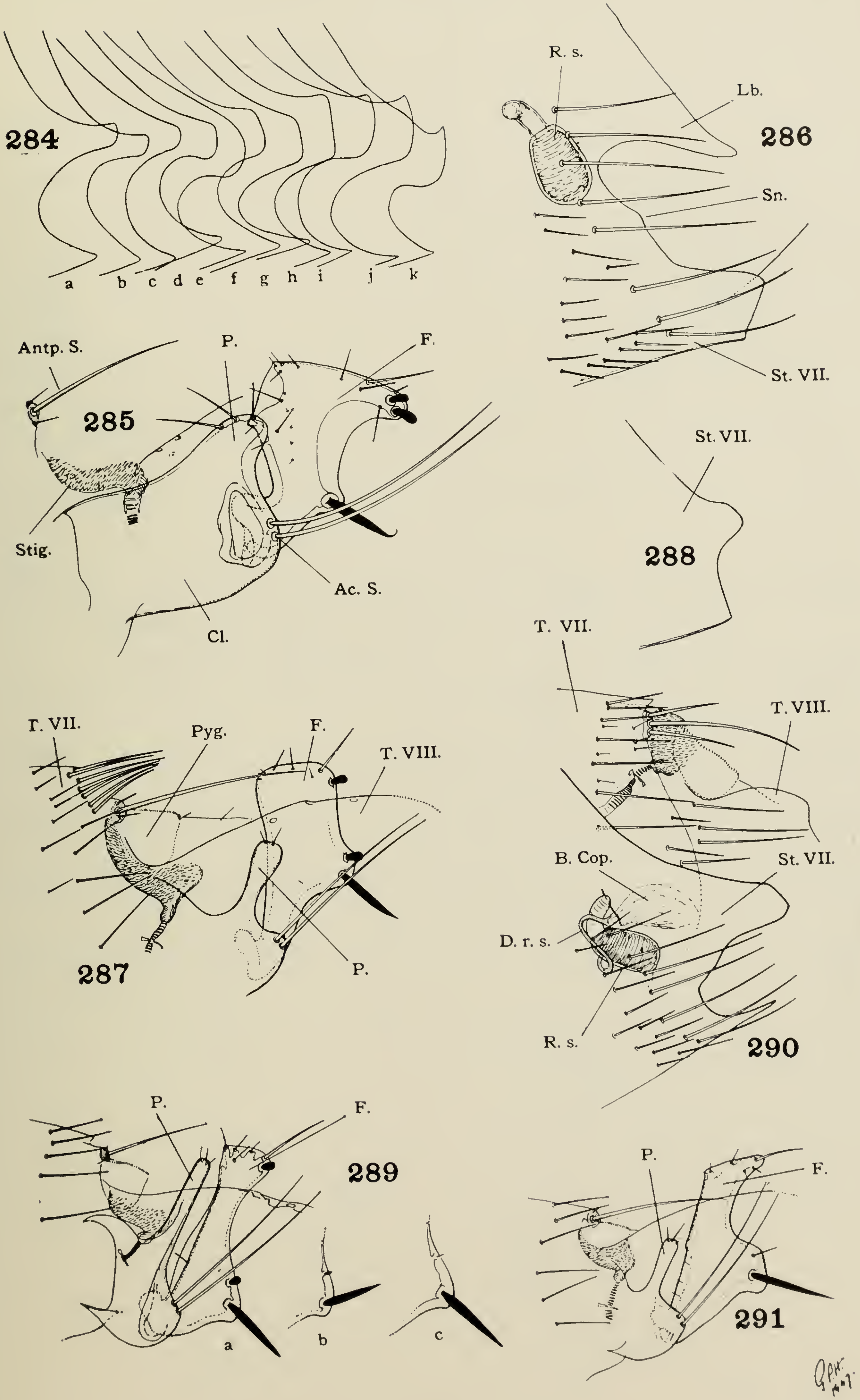
Fig. 287. *Megabothris groenlandicus* (Wahlgren). Stigma VIII and processes of clasper of male (Pangnirtung, Baffin Is.).

Fig. 288. *Megabothris immitis* (Jordan). Sternum VII of female (after Jordan).

Fig. 289. *Megabothris lucifer* (Rothschild). Stigma VIII and processes of clasper of male (a, Estevan, Sask.; b, Kamloops, B.C.; c, Estevan).

Fig. 290. *M. lucifer.* Spermatheca and abdominal segments VII and VIII of female (Estevan, Sask.).

Fig. 291. *Megabothris quirini* (Rothschild). Stigma VIII and processes of clasper of male (Elkwater, Alta.).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a b c d e f g h i j k
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Lb.
286
Sn.
St. VII.
Antp. S.
P.
F.
285
Stig.
Ac. S.
Cl.
St. VII.
288
T. VII.
Pyg.
F.
T. VIII.
287
P.
T. VII.
T. VIII.
B. Cop.
St. VII.
D. r. s.
R. s.
290
P.
F.
289
a
b
c
P.
F.
291

Plate XXXVII

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 292. *Megabothris quirini* (Rothschild). Spermatheca and abdominal segments VII and VIII of female (topotype; Red Deer, Alta.).

Fig. 293. *Megabothris obscurus* n. sp. Genitalia of male (holotype).

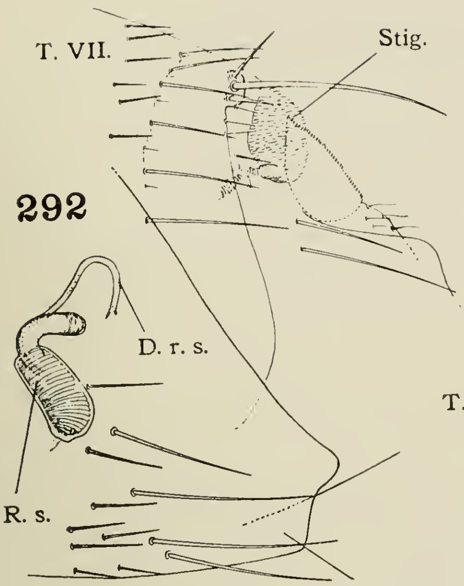
Fig. 294. *M. obscurus.* Moveable process of clasper (paratype; Stanmore, Alta.).

Fig. 295. *Monopsyllus ciliatus protinus* (Jordan). Stigma VIII and processes of clasper of male (Harrison Bay, B.C.).

Fig. 296. *M. ciliatus protinus.* Spermatheca and abdominal segments VII and VIII of female (Cultus Lake, B.C.).

Fig. 297. *Monopsyllus eumolpi eumolpi* (Rothschild). Stigma VIII and processes of clasper of male (Kinbasket Lake, B.C.).

Fig. 298. *M. eumolpi eumolpi.* Spermatheca and abdominal segments VII and VIII of female.



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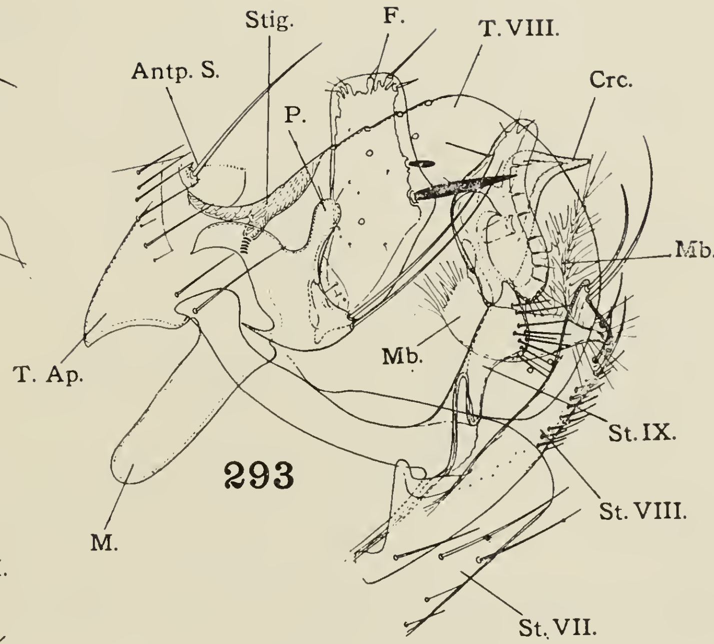

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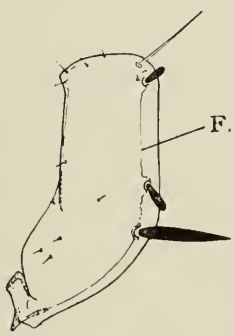

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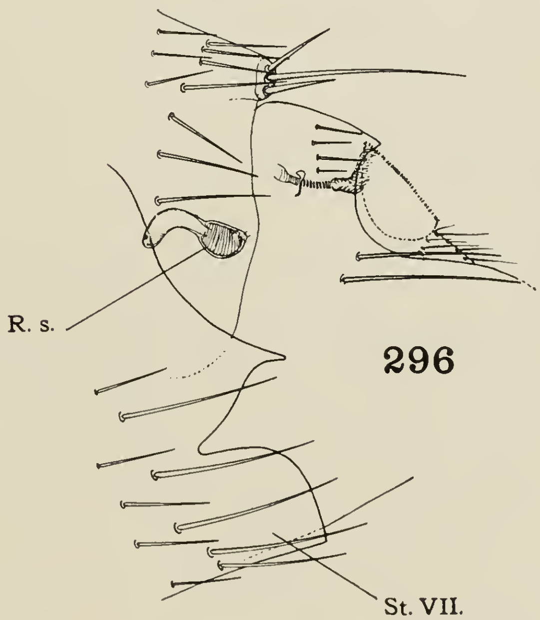

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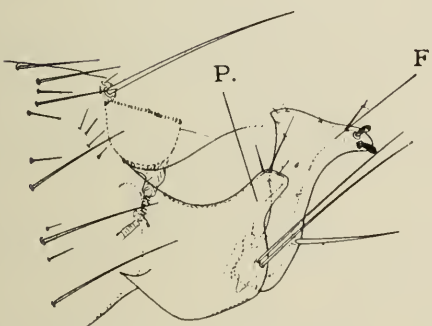

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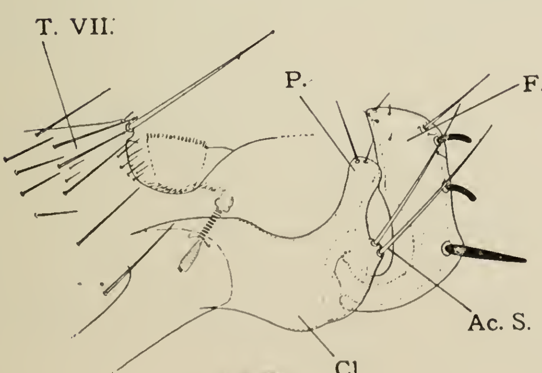

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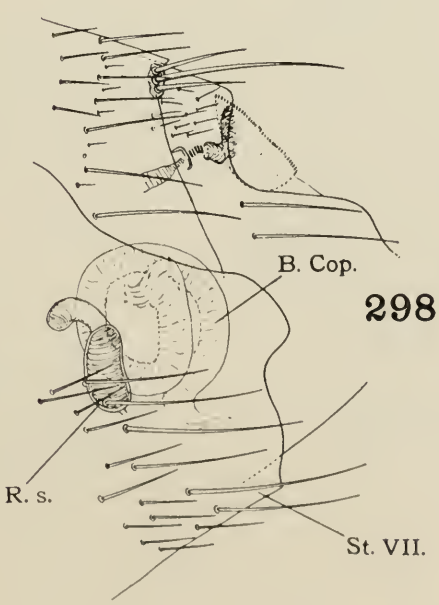

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Plate XXXVIII

Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

Fig. 299. *Monopsyllus thambus* (Jordan). Stigma VIII and processes of clasper of male (Reliance, N.W.T.).

Fig. 300. *M. thambus.* Spermatheca and abdominal segments VII and VIII of female. Variation in sternum VII (a-h, series from Reliance and other localities in N.W.T.).

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Fig. 302. *M. vison.* Spermatheca and abdominal segments VII and VIII of female (Kinbasket Lake, B.C.).

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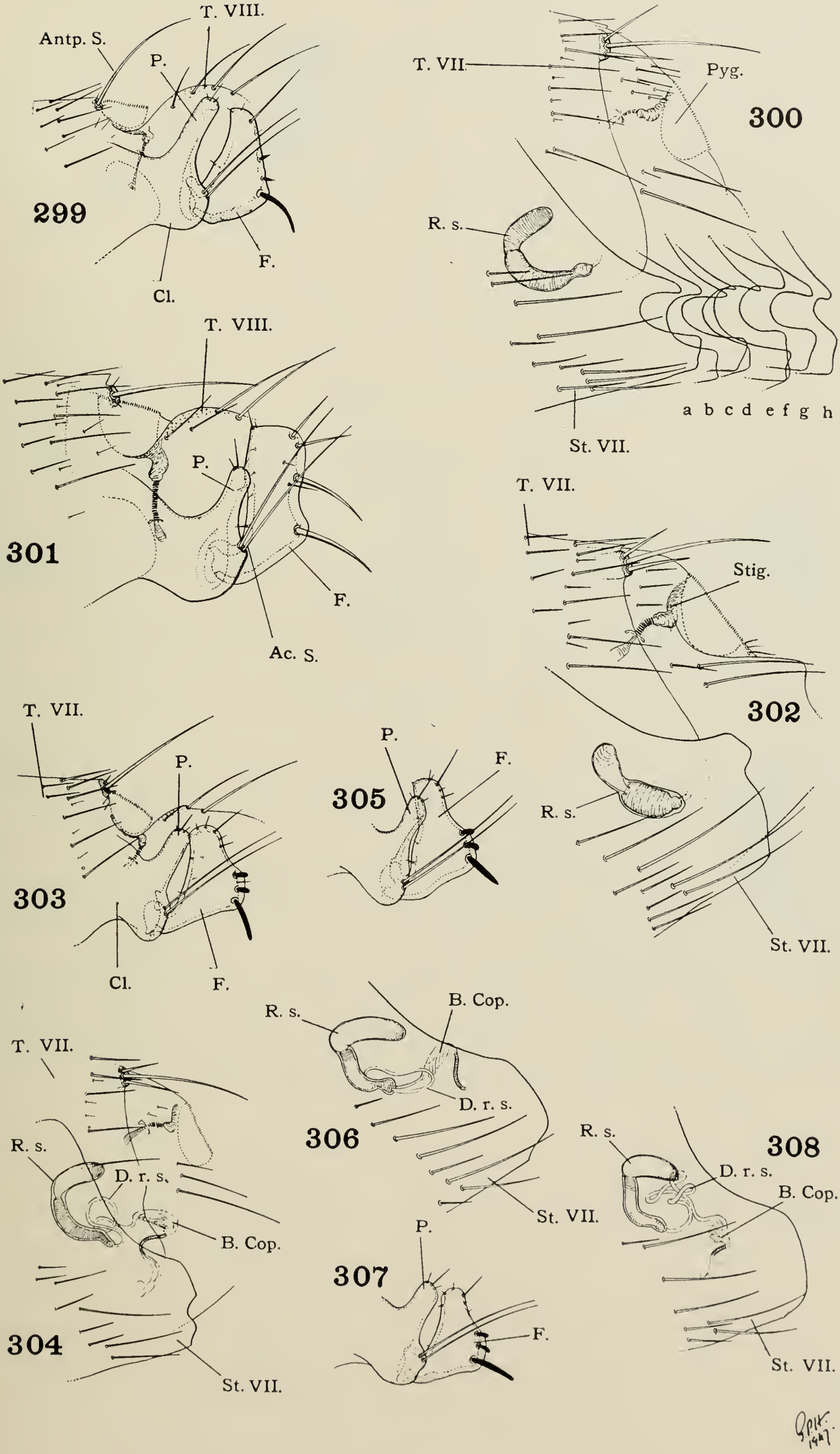
Fig. 304. *M. wagneri wagneri.* Spermatheca and abdominal segments VII and VIII of female.

Fig. 305. *Monopsyllus wagneri ophidius* (Jordan). Processes of clasper of male (Vancouver, B.C.).

Fig. 306. *M. wagneri ophidius.* Spermatheca and sternum VII of female (Harrison Bay, B.C.).

Fig. 307. *Monopsyllus wagneri systaltus* (Jordan). Processes of clasper of male (topotype; Blackfalds, Alta.).

Fig. 308. *M. wagneri systaltus.* Spermatheca and sternum VII of female (topotype).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T. VIII.
P.
F.
Cl.
300
T. VII.
Pyg.
R. s.
St. VII.
a b c d e f g h
301
T. VIII.
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F.
Ac. S.
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T. VII.
Stig.
R. s.
St. VII.
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T. VII.
P.
Cl.
F.
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P.
F.
304
T. VII.
R. s.
D. r. s.
B. Cop.
St. VII.
306
R. s.
B. Cop.
D. r. s.
St. VII.
307
P.
F.
308
R. s.
D. r. s.
B. Cop.
St. VII.

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Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

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Subfamily Leptopsyllinae

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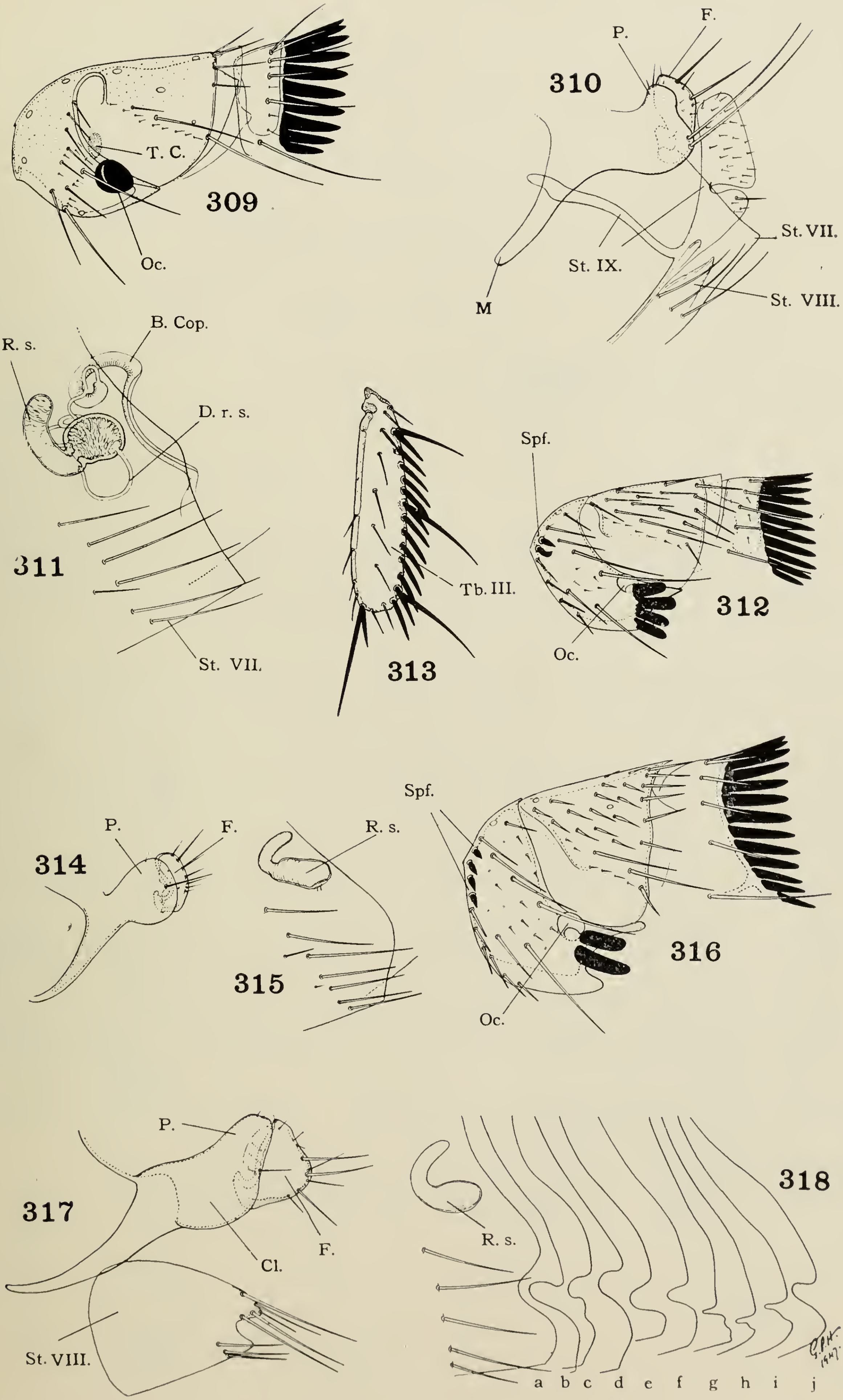
Fig. 318. *P. ravalliensis.* Spermatheca and variation in sternum VII of female (a-h, Kinbasket Lake; i-j, Vavenby, B.C.).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Oc.
310
F.
P.
St. VII.
St. IX.
St. VIII.
M
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B. Cop.
R. s.
D. r. s.
St. VII.
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Tb. III.
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Spf.
Oc.
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P.
F.
315
R. s.
316
Spf.
Oc.
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F.
Cl.
St. VIII.
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a b c d e f g h i j
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Plate XL

Family CERATOPHYLLIDAE

Subfamily Leptopsyllinae

Fig. 319. *Peromyscopsylla hesperomys pacifica* n. ssp. Preantennal region of head of female (allotype; Vancouver, B.C.).

Fig. 320. *P. hesperomys pacifica.* Genitalia of male (holotype; Vancouver, B.C.).

Fig. 321. *P. hesperomys pacifica.* Detail of moveable process of clasper (enlarged scale).

Fig. 322. *Peromyscopsylla hesperomys hesperomys* (Baker). Detail of moveable process (Ithaca, N.Y.; specimen from R. Traub).

Fig. 323. *Peromyscopsylla hesperomys hemisphaerium* Stewart. Detail of moveable process (paratype; Monterey Co., Cal.).

Fig. 324. *Peromyscopsylla hesperomys* ssp.; spermatheca and sterna VII of females (a-e, *P. h. pacifica;* f, *P. h. hesperomys*, Ithaca, N.Y., from R. Traub; g-h, *P. h. hemisphaerium*, paratypes, Monterey Co., Cal.).

Fig. 325. *Peromyscopsylla catatina* (Jordan). Preantennal region of head of female (Pancake Bay, Algoma, Ont.).

Fig. 326. *P. catatina.* Clasper and sternum VIII of male.

Fig. 327. *P. catatina.* Spermatheca and sternum VII of female (Brule Lake, Algonquin Park, Ont.).

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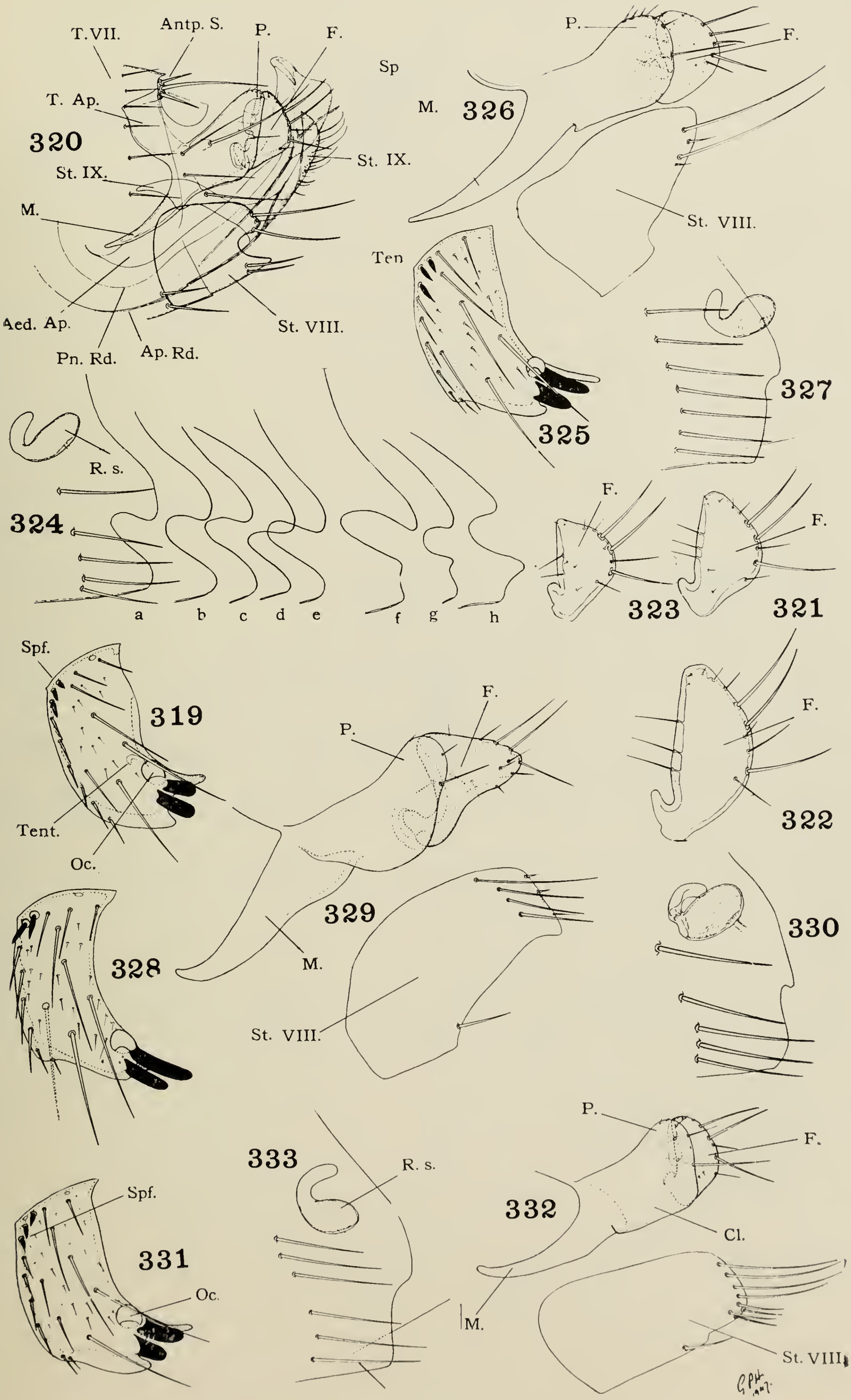
Fig. 329. *P. hamifer hamifer.* Clasper and sternum VIII of male.

Fig. 330. *P. hamifer hamifer.* Spermatheca and sternum VII of female (Kapuscasing, Ont.).

Fig. 331. *Peromyscopsylla selenis* (Rothschild). Preantennal region of head of female (Kinbasket Lake, B.C.).

Fig. 332. *P. selenis.* Clasper and sternum VII of male (Berg Lake, B.C.).

Fig. 333. *P. selenis.* Spermatheca and sternum VII of female.



T.VII.
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St. IX.
St. IX.
M.
St. VIII.
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Aed. Ap.
St. VIII.
Pn. Rd.
Ap. Rd.
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h
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F.
323
321
Spf.
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F.
322
Tent.
Oc.
329
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St. VIII.
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332
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M.
St. VIII.

Plate XLI

Family ISCHNOPSYLLIDAE

Fig. 334. *Eptescopsylla vancouverensis* (Wagner). Head and part of thorax of female (topotype; Vancouver, B.C.).

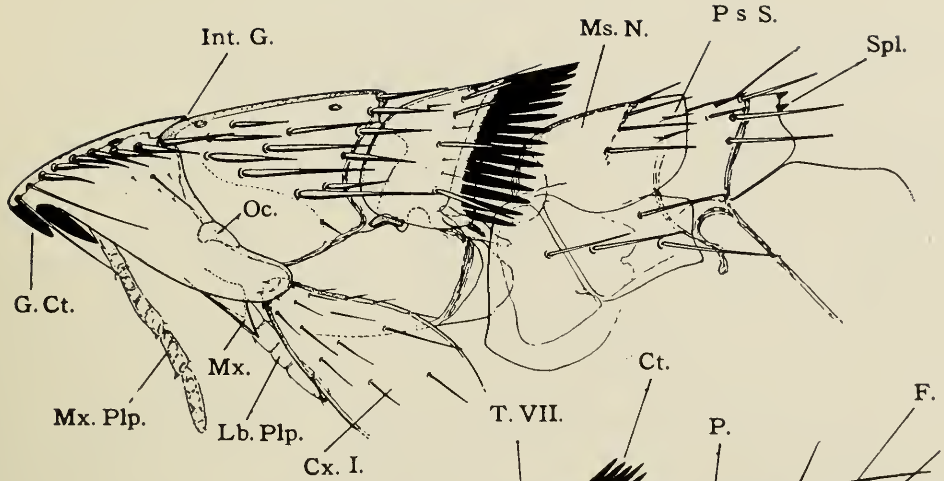
Fig. 335. *E. vancouverensis.* Genitalia of male (topotype).

Fig. 336. *E. vancouverensis.* Spermatheca and sternum VII of female (paratype).

Fig. 337. *Myodopsylla insignis* (Rothschild). Head and pronotum of male (Blackfalds, Alta.).

Fig. 338. *M. insignis.* Abdominal terga II and III of male, showing "false combs".

Fig. 339. *Myodopsylla gentilis* Jordan and Rothschild. Genitalia of male (Cowichan Lake, V. I., B.C.).



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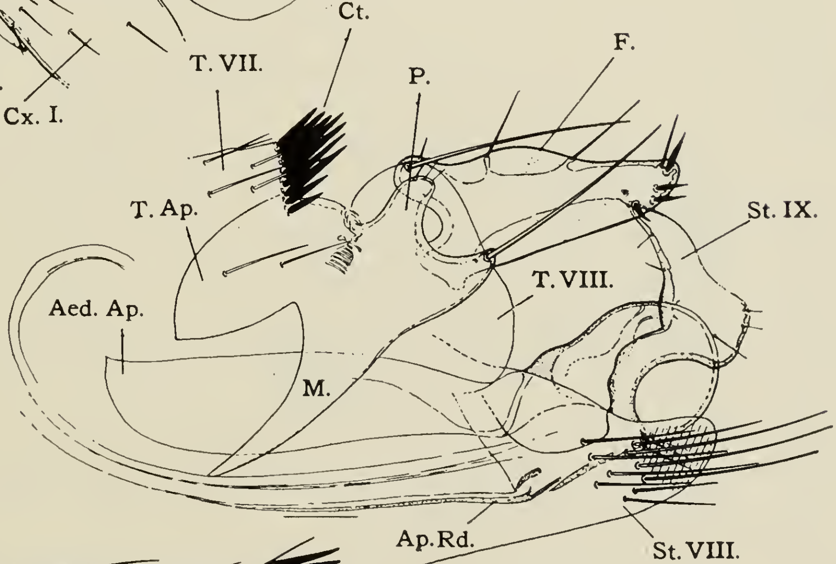

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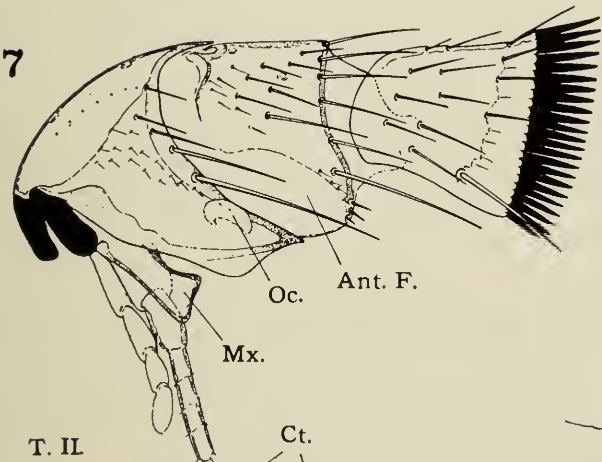

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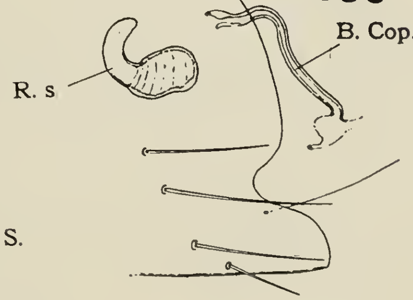

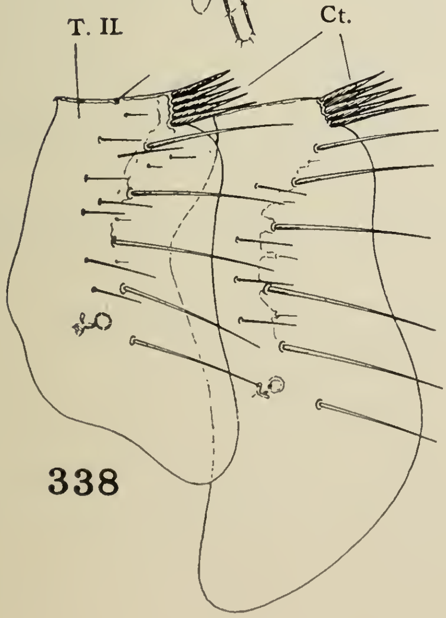

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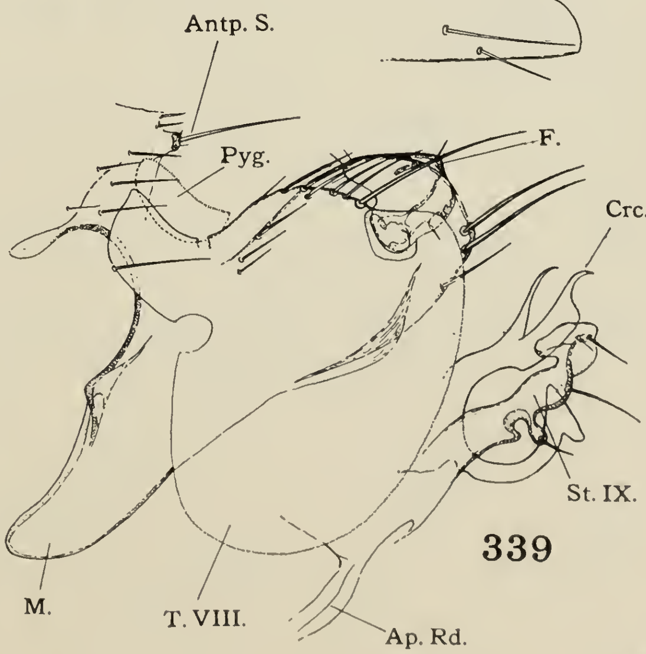

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Plate XLII

Family ISCHNOPSYLLIDAE

Fig. 340. *Myodopsylla insignis* (Rothschild). Enlarged detail of apical portion of clasper of male (Blackfalds, Alta.).

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Fig. 342. *M. insignis.* Enlarged detail of spermatheca.

Fig. 343. *Myodopsylla gentilis* Jordan and Rothschild. Enlarged detail of apical portion of clasper of male (Cowichan Lake, B.C.).

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Fig. 345. *Myodopsylloides palposus* (Rothschild). Head and pronotum of male (allotype; Kamloops, B.C.).

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Family CERATOPHYLLIDAE

Subfamily Ceratophyllinae

(continuation from plate XXXV)

Fig. 349. *Megabothris asio asio* (Baker). Processes of clasper of male (Rutland, Vermont; specimen received from Robert Traub).

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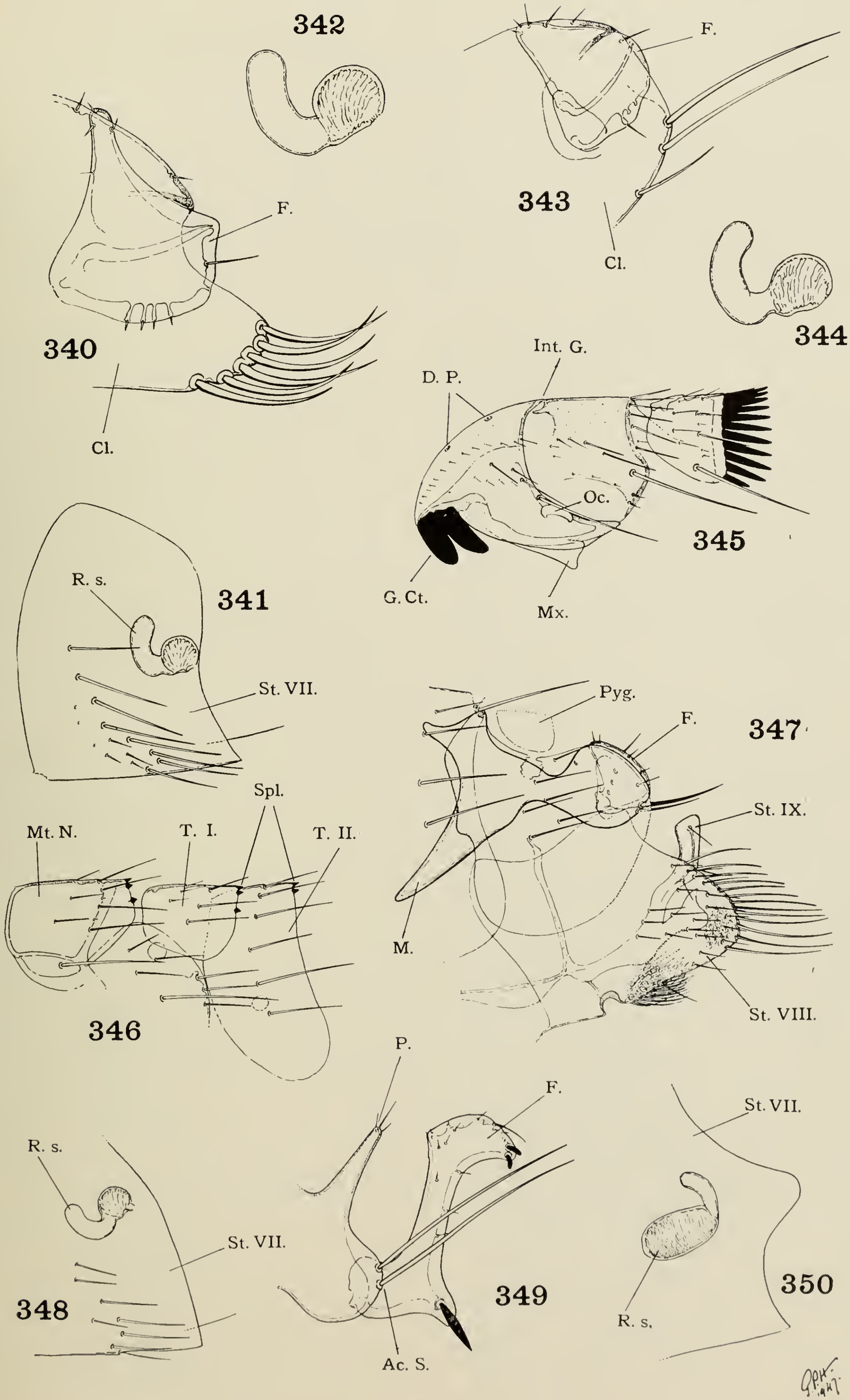
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Cl.
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F.
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Cl.
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References to definitions of anatomical structures used in taxonomy are supplied.

Hosts are indexed down to genus only, fuller data being available in the host-flea index, pp. 183-195.

OTTAWA
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